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The 1921 meetings of the American Conference of Pharmaceutical Faculties and the National Association of Boards of Pharmacy will also be held in New Orleans during Convention Week

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BALTIMORE, MD.

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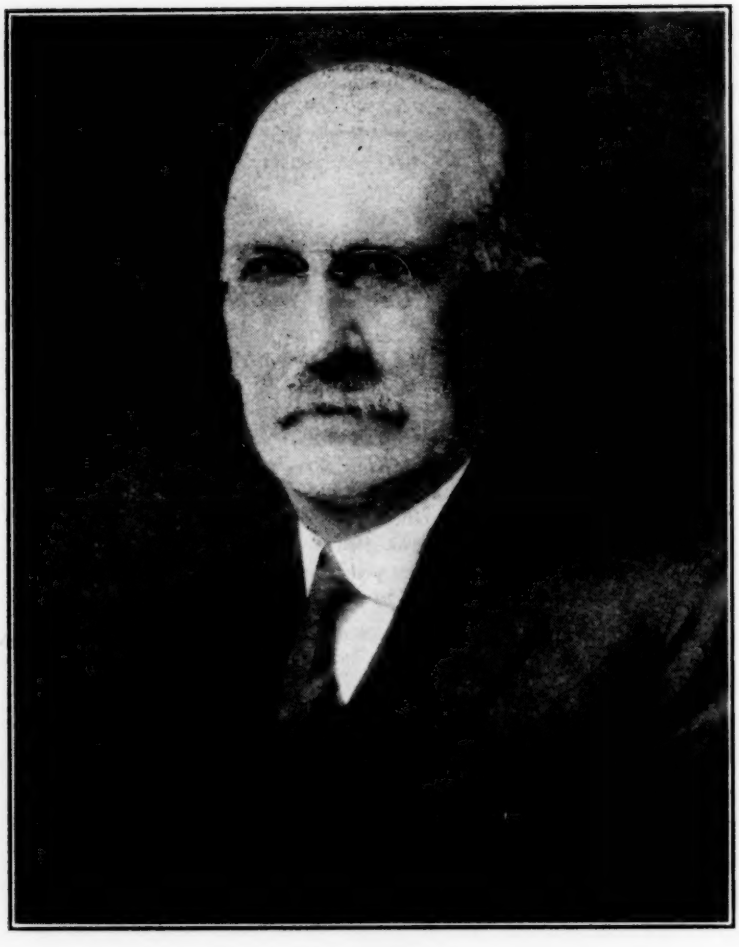
First Chairman of Section on Practical Pharmacy and Dispensing, A. Ph. A., 1900–1901

Chairman of Section on Commercial Interests, A. Ph. A., 1905–1906

Chairman of the House of Delegates, A. Ph. A., 1915–1916



H. P. HYNSON

JOURNAL OF THE AMERICAN PHARMACEUTICAL ASSOCIATION

VOL. X MAY 1921 NO. 5

HENRY PARR HYNSON.

On Tuesday morning, April 19th, there died suddenly at the University Hospital, Baltimore, Maryland, Dr. Henry Parr Hynson, who had become by his energy one of our useful and popular citizens and a pharmacist of national reputation.

Like many men who have attained prominence in this great nation, Henry Parr Hynson lived his early life in the country. Born on a farm near Still Pond, Kent County, Maryland, on May 27th, 1855, the son of Nathaniel T. and Anne Medford Hynson, he attended the neighboring public schools and then was a student at the Academy of Middletown, Delaware, for about two years. While there, his father, who owned a drug store at Sudlersville, Md., became ill and Henry, at the age of 14, was compelled to leave school to attend to his father's store. He came to Baltimore in 1875 and entered the Maryland College of Pharmacy, from which he was graduated in 1877 at the head of his class, winning the first college prize and also being awarded the alumni prize for proficiency in Analytical Chemistry. In 1882 he opened his own store at the corner of Baltimore and Calhoun Streets, and later another under the Hotel Altamont at Eutaw Place and Lanvale Street. In 1889 he connected with J. W. Westcott and established the firm of Hynson, Westcott & Co., locating at the corner of Charles and Franklin Streets, where his executive ability soon reaped its fruits. This firm, entering the manufacturing field, later took in Dr. H. A. B. Dunning under the name of Hynson, Westcott & Dunning, and it has attained its place in the front rank of pharmaceutical reputation.

Soon after his graduation he joined the Maryland Pharmaceutical Association and served as the President of that body in 1895. He also has served as President of the Alumni Association of the Maryland College of Pharmacy and as Secretary of the Maryland College of Pharmacy and of the Maryland State Board of Pharmacy. For several years he lectured on Pharmacy at the College of Physicians and Surgeons and at the Women's Medical College and since 1901 has occupied the Chair of Commercial Pharmacy and Dispensing at the Maryland University, Department of Pharmacy. For several years he was Brigade Hospital Steward of the Maryland National Guard. He was one of the chief organizers and the first President of the National Association of Retail Druggists; and it might be truthfully said was the creator of the Section on Practical Pharmacy and Dispensing of the American Pharmaceutical Association, serving as its first Chairman (1900–1901); he was one of the prime movers in the organization of

the House of Delegates, A. Ph. A., and the American Conference of Pharmaceutical Faculties. He officiated as temporary President when the latter was organized in 1900, and served as President of the Conference in 1908–1909. He was Chairman of the House of Delegates during the year 1915–1916. From 1905–1906 he was Chairman of the Section on Commercial Interests. His work on the National Formulary Committee, the Pharmaceutical Syllabus, the A. Ph. A. Recipe Book, and other important committees are splendid records of his activities, for he never held place on any of them without rendering real service. He was also much interested in civic work and took active part in several Baltimore organizations for civic improvement, serving in them with cheerfulness and enthusiasm. Only recently he was elected President of the Eastern Shore Society. He was locally and nationally active as a member and official of the Rotarians.

As a recognition of his zeal in his profession, the University of Maryland conferred upon him the Honorary Degree of Doctor of Pharmacy in 1907.

In some respects Henry P. Hynson was one of the most remarkable men whom I have known in pharmacy. In his younger days he was capable of much labor and exhibited a tenacity of purpose that knew nothing of failure, and he fought hard for principles that he thought were for the betterment of his profession. He was a ready and witty speaker, a forceful writer and a man of resource, who reasoned well and strongly when in debate. That he liked admiration was true, but this love of approbation was always modestly exhibited and was associated with convictions that gave steadiness to his character rather than otherwise, and we in Baltimore knew how he strove to secure the confidence of his associates.

His perceptive and receptive faculties were highly developed and enabled him to take impressions from many sources—from nature, from books and from men, and what he obtained he held with retentive memory. Mentally he was a ready man and generally well prepared upon most subjects for discourse or exposition and he could comprehend and appreciate their treatment by others. He was very sensitive to the influence of his immediate surroundings, whether of an audience or a companion, and he received impressions as well as gave them, in a sympathetic way.

To say that his death has shocked me would be a commonplace. When one has attained the age of four-score and over, death is no longer a shock. It has hovered so long over one's career, picking this and then that of one's friends, that it almost becomes a familiar spirit.

The career which has closed was not all sunshine. We, who have seen him closer, know the change that came upon him after the death of his son and namesake, Lieut. Henry P. Hynson, Jr., who was accidentally killed while serving his country shortly after peace was declared. This affliction, following the death of his wife, to whom he had been devoted in her long illness, softened his nature and completed the mosaic of a man who was naturally generous and charitable, and it gave us a better aspect of the many-sidedness of his character.

Dying as he did, without any of his immediate family near him, imparted a sadness that had its compensation in the respect paid him by the large attendance at his funeral, which was held at the "Memorial Protestant Episcopal Church," on Saturday afternoon, April 23rd. Here was gathered a large assemblage of both sexes. His family, and delegations from the American Pharmaceutical Association, the Maryland Pharmaceutical Association, the Baltimore Retail Druggists' Association, the Wedgewood Club, the Rotary Club, the Eastern Shore Society and other organizations with which he had served, there paid their last tribute to him and will long cherish—

"That best portion of a good man's life,
His little, nameless, unremembered acts of kindness and of love."

JOHN F. HANCOCK, PHAR.D.

EDITORIAL

E. G. EBERLE, Editor 253 Bourse Bldg., PHILADELPHIA

"CRAM" COURSES IN PHARMACY AND PREREQUISITE REQUIREMENTS.

SEVERAL years ago a special committee of the American Conference of Pharmaceutical Faculties found that there were about twenty-five institutions giving "cram" courses in pharmacy. So far as it is possible to determine there are nearly as many to-day but some of them have a much reduced enrollment and it is evident from their advertising matter that most of them see that their days are numbered. Consequently they are making a strong bid for students *now*. They are directing attention to the fact that the legislatures are passing prerequisite laws which debar any but college graduates from examinations and are urging those who wish to become pharmacists to take these plugging courses immediately. They say also that examinations cover more subjects and are more difficult.

Besides this placing of greater emphasis on the necessity of enrolling quickly their literature is not much changed. Just a few things have come to light that invite comment.

An institution in an eastern city which conducts quiz (spelled quizz) classes and correspondence classes advertises its own quiz books as the "best buy any Drug Clerk can make," quoting in this connection from the letter of a purchaser in a near-by state, "I have passed my State Board requirements. Every question that was asked on the recent examination, I found in your books." We may not all reach the same conclusions but certainly no board member who is at all interested in the administration of his office wants to think that it is possible for people to memorize the answers to all the questions in a quiz-compend and thereby get registered.

With perhaps one exception these so-called schools (most of them are one-man or one-woman affairs) make no claim other than that of preparing people to pass Board examinations. One, however, gives degrees, as many as, possibly more than, any reputable college in the country. Pay your money and take your choice, Ph.G., Ph.C., Pharm.B., Pharm.D. To get the Ph.G. degree, it is necessary to become a registered pharmacist after taking their correspondence course, and to present a thesis of five thousand words. The requirements for Pharm. B. and Ph.C. are the same as for Ph.G. with a high school diploma and two years in college additional. "To be eligible for the Doctor of Pharmacy degree the candidate must prove that he or she is either a Registered Pharmacist or is a graduate of a College of Pharmacy and has a Ph.G. degree (Registered Pharmacists not college graduates will be required to take two examinations, the first leading

to the Ph.G. degree and second leading to the Pharm.D. degree)." So much for eligibility. "The course," the circular says, "will consist of ten large lessons forwarded to the student by mail. The student will receive one lesson at a time, the lessons being sent at various intervals during a period of nine months." Think of it! You may take this "cram" course and having passed a Board examination take more correspondence work and become a Doctor of Pharmacy without ever having stepped inside of a real college of pharmacy. Why not? The course is "under the supervision of capable professors, who were formerly connected with various pharmaceutical institutions and colleges." A later communication conveys the information that users of the Pharm.D. degree, in a certain state, need not fear prosecution and others need not be deterred from taking the course, because a satisfactory agreement has been reached with the authorities whereby the holder need only attach, in parenthesis after the degree, the name of the state where the institution is located, to show in what state it is chartered. Then follows this statement: "The addition of such description is so general that our representatives felt these suggestions were very satisfactory and willingly agreed to advise our graduates to adopt them. Graduates of Oxford, Cambridge, Durham, Yale, Harvard and similar institutions frequently do this in order to establish the value of the degree and we believe the same custom on the part of our graduates will redound to the credit of the University and the individual."

Texts for several sermons could easily be selected from these quotations to say nothing about what can be read between the lines but both are so obvious that any comment seems almost superfluous. In the face of these facts it passes comprehension that there can be opposition to prerequisite legislation. With the National Association of Boards of Pharmacy pledged to require two years of college work in 1923 and these "cram" schools urging people to enroll now, the time intervening is bound to mean one grand rush to "get registered" before it is too late and the states without prerequisite laws will become the dumping ground of incompetents from other states.

ZADA M. COOPER.

EDUCATION AND TRAINING ESSENTIAL FOR SUCCESS IN BUSINESS AND PROFESSIONAL LIFE.

"BIG BUSINESS" has recognized that education gives a dollars and cents return in commercial life. Business houses, manufacturing establishments, banks, insurance companies, newspapers, in fact, all those lines of endeavor in which a large part of the earning capacity of the worker is based upon his ability to understand his fellows, have come to realize the advantages possessed by the educated man over his less fortunate brother who may have an equal amount of native ability but is handicapped in applying it.

These statements are not theories or suppositions, but cold facts, easily ascertained by the most cursory investigation. Why, then, should we waste time in discussing whether pharmacy should be divided into the professional and the business branches, and the need for different educational requirements in the two divisions. Most of us are agreed that we need better trained professional pharmacists. Is there any less need of more education for the commercial pharmacist if he is to keep up with the progress of modern business?

The man who enters commercial pharmacy to-day finds that the responsibilities are much greater and his business relations more complex than twenty or even ten years ago. If he is to make himself a success rather than join the ranks of the thirty-five percent of retail druggists in this country who are eking out a mere livelihood, he must have a broader business training. This is necessary not only for the commercial pharmacist but for the professional man as well, if he is to realize on the full value of his professional education.

There are some who argue that the colleges should make their courses as practical as possible. This is a good thing, but within limits. It is not the function of a college or university to train men in the petty details of business or of a profession but to give them a thorough schooling in the fundamentals of business science, or of their profession, which they can apply to detail problems as they meet them. The student of medicine must spend his period of internship after his graduation from a school of medicine. Why do we not realize that the year or two which a man spends in store, wholesale establishment, manufacturing house, or laboratory after his graduation from a college of pharmacy, is his period of internship? It is not possible or desirable that a student should spring, full-grown, from the loins of his alma mater into a waiting position and immediately begin to function as though he had years of practical experience behind him.

We must realize that if the man in pharmaceutical work in the future is to measure up to the business man and the professional man in other lines, and to meet them as an equal, he must have a broader viewpoint of his own particular subject, and of the world in general. The problem of our colleges of pharmacy, then, is to give their students the wider training which business and professional students in other branches are getting, and not merely to give them more "practical" training as the term is generally understood. W. J. McGill.

THE NEED OF ORGANIZATION AND COÖPERATION IN AMERICAN PHARMACY.

THE great need of American pharmacy to-day is organization and coöperation. To the student of political and social economy who might have the patience to investigate it, the situation of American pharmacy would present a

very interesting study; this situation would also explain why pharmacy means so little to the general public and particularly to the law makers and law enforcers. He would be particularly impressed with the fact that during the time that organization or confederation is the order of the day, American pharmacy is not nationally organized except as to its divisions or phases. It is, of course, the fact that American pharmacy was nationally organized in the early fifties in the American Pharmaceutical Association, but that this organization, through its failure to realize and meet the emergencies arising, permitted the formation of divisional organizations unaffiliated with itself, and now, because of these divisional organizations, is unable to function as a national organization. It is equally true that no one of these divisional organizations can function as a national organization for pharmacy, and they are also experiencing the usual difficulty of such organizations in again amalgamating, through fear that each will lose some peculiar advantage. To complicate the situation even more and to further emphasize the need for a real national organization, the divisional organizations and the American Pharmaceutical Association are working together, as effectively as can be done under the conditions, in the American Drug Trade Conference.

The other interesting phase to such a student would be that while we have failed to develop a national organization, we have developed state organizations, embracing within their membership or by affiliation all phases of pharmacy—the retail pharmacist, the wholesale pharmacist, the manufacturing pharmacist, the teacher, the salesman and others, harmonizing these interests and functioning quite effectively as a general association for the state. They find themselves, however, very much in the position of the political units of this Republic before the adoption of the Constitution—as effective geographical units, but unable to function in a national way because of no national association.

Those who study the situation must realize that American pharmacy will again become nationally organized in the American Pharmaceutical Association, either in its present form or suitably modified, when the American pharmacists realize through education or through enough of such sad and humiliating experiences as were undergone during the late war, or through burdensome legislation, that a national organization to represent them is absolutely necessary; in other words, when American pharmacists become class conscious, or, if the reader is sensitive, professionally conscious. The American lawyer, physician, chemist, dentist, and others are class conscious, and as a result we have such effective national organizations as the American Bar Association and American Medical Association.

Some far-seeing thinkers have become convinced that the most effective way to again reëstablish the American Pharmaceutical Association is to confederate

with it in some way these state organizations. The American Pharmaceutical Association has, to bring this about, provided for a House of Delegates as one of its two main divisions, the House of Delegates being made up of delegates from the state associations only; the other division, the Council, at present having members elected by the Association and by its local branches. If this confederation can be brought about, the local branches would become units of the state organizations, and consequently, the Council members would be elected in part by the latter.

This is not only a statement of self-evident facts, but it is in the main a call to the state pharmaceutical associations, as strong as it can be made, to take advantage of this opportunity to again form a national organization for pharmacy, with which the divisional organizations could become affiliated, which affiliation, it should be emphasized, need not in any way affect the value of such divisional organizations as the National Association of Retail Druggists, National Wholesale Druggists' Association, and others. If anyone doubts that this is a possibility, he need only be referred to the divisional organizations within the American Medical Association, the American Chemical Society, or if it is preferred to take an example outside of the professional field, the effective work of the Railroad Brotherhoods within the American Federation of Labor may be studied. At present the National Association of Boards of Pharmacy and the American Conference of Pharmaceutical Faculties meet at the same time and place with the American Pharmaceutical Association, and there is close accord and very effective coöperation between the three.

The financial difficulty presented in the dues to be paid to the national organization is constantly emphasized as the great difficulty in the way of the confederation. If this is admitted, it is certainly possible for American pharmacy to handle this difficulty as American chemists, or American physicians, or any other class of business or professional men have done—by establishing a joint fee, which will make the payments lighter upon the various phases of pharmacy, and give us more efficient service at less cost.

The need for a national organization is insistent; and all who have faith in American pharmacy and its possibility of service in the future must realize the gain of time and effort in going along with and not in opposition to a natural movement leading to national organization and coöperation. So let us make a start by making the House of Delegates a clearing house for the state associations.

E. F. KELLY.

"RECOGNIZED SCHOOLS OF PHARMACY" AND THE PREREQUISITE FOR EXAMINATION AND REGISTRATION.

During the few months of office of the present Chairman of the Executive Committee of the American Conference of Pharmaceutical Faculties a number of facts have come to his attention which are of the gravest concern for the future standing and influence of the Conference. Early in the year a letter was received from the Secretary of the State Board of Pharmacy of one of our most progressive states in which he complains of the standing of one of the Conference Schools in a nearby state. According to the statement of the Secretary, the Board of Pharmacy had refused to permit the graduates of this institution to take their examination for licensure. This refusal was based upon the assumption that this school was not maintaining proper standards. In the Secretary's letter to the Chairman appears this statement:

"Our Board of Pharmacy has a ruling requiring graduation from a *recognized* school of Pharmacy as a prerequisite to examination and registration in this state. Assuming that the following definition would suffice to shut out all inferior schools we defined 'recognized school' as one which was a member of, or eligible to membership in the American Conference of Pharmaceutical Faculties. Within the last month one of its (the school's in question) graduates applied for reciprocal registration and another for examination. I at once turned them down. Immediately the dean of the school 'went to the mat' with me, informing me that his school was a member of the American Conference of Pharmaceutical Faculties. It was then up to me to handle the matter as gracefully as I could as I saw by our own ruling I was beaten and his graduates must be admitted." Then follows this significant sentence: "Of course we were wrong in assuming that membership in the Conference was evidence of the standing we desired."

The Chairman of the Executive Committee is not as yet in a position to say whether the school in question is maintaining Conference standards. This in itself is of little concern. The serious aspect of the whole matter is the charge implied in the Secretary's statement. This charge amounts practically to this—that membership in the Conference means nothing.

It is a matter of common knowledge that for a number of years the Conference has used every dignified means possible to induce the Carnegie Foundation to make a systematic investigation and classification of the schools of Pharmacy. This has failed and the time has come when an investigation and classification is imperative. The Chairman believes that a plan must be devised for making such a study by the Conference itself. He grants that it would be most desirable to have this investigation conducted by an outside agency. This, however, does not seem probable of realization. The medical schools holding membership in the Association of American Medical Colleges have not hesitated to make their own investigation and classification. Their work was productive of much good.

The Chairman believes that the Conference should at once begin to plan to set its own house in order. In the near future he will himself suggest a plan of investigation and classification for the purpose of provoking constructive criticism. In the meantime he hopes for suggestions upon any phase of the subject

either in the columns of the JOURNAL or to him personally. He is earnestly desirous of knowing what is in the minds of the Conference membership. A definite plan must be presented for action at the next meeting of the Conference at New Orleans. This is necessary in order that Conference membership may mean something and in order that the Conference may exert a greater influence in matters educational and legislative.

(Signed) R. A. LYMAN,
Chairman Executive Committee,
American Conference of Pharmaceutical Faculties.

THE APPLICATION OF OPTICAL METHODS TO THE EXAMINATION OF INSECTICIDES AND FUNGICIDES.*

BY GEO. L. KEENAN.

In the course of the microscopical examination of products for the Insecticide and Fungicide Board, the writer has found it advantageous to make use of optical (and microchemical) tests for the identification of the ingredients contained in the various samples submitted. The application of optical-crystallographic measurements has heretofore been largely employed for the identification of minerals, especially as they occur in rocks or as they are produced synthetically. Recently Dr. Edgar T. Wherry, Crystallographer of the Bureau of Chemistry, has extensively used optical-crystallographic methods in the identification of alkaloids and other organic compounds. Such determinations have been found to be of considerable assistance to the chemist in the identification of these products. The success attending the use of such data led the writer to consider their application to the identification of ingredients commonly found in insecticides and fungicides.

A large number of the insecticides and fungicides submitted for microscopical examination are simple mixtures, consisting of some powdered vegetable materials, with or without varying proportions of inorganic and organic substances, or consisting wholly of inorganic materials. The product is often of such a nature that it can be readily separated into portions by sifting through a 40-mesh or 60-mesh sieve. The very fine powder which passes through the sieve is subjected to close scrutiny under the microscope. The coarser portions remaining upon the sieve are spread upon a sheet of paper and examined with the aid of a hand lens (magnifying about 10 diameters). Various separations can be made with the aid of forceps and particles removed which can be examined as to their optical properties.

For the purpose of studying the optical properties of any crystalline fragments, it is essential that the microanalyst be provided with a microscope equipped with nicol prisms. An ocular with cross-hairs, a 4-millimeter, an 8-millimeter, and a 16-millimeter objective are usually all the necessary lenses that are required. A slit should be provided in the microscope tube above the objective and below the upper nicol prism for the insertion of a selenite plate, commonly designated as "red, 1st order." A rotating stage, an Abbé condenser, and a substage iris

* Contribution from Insecticide and Fungicide Board and Bureau of Chemistry, Department of Agriculture, Washington, D. C.

diaphragm are also quite necessary. Liquids of known refractive index, usually oily in character, are needed, in which to immerse the crystal fragments. The value of the index of each liquid is first determined by means of a refractometer. For most identification purposes, the liquids used differ in index only by two units in the second decimal place, that is, 1.48, 1.50, 1.52, 1.54.

Fragments of crystalline material picked out of a sample are crushed on a microscopical slide and immersed in any one of the liquids whose refractive index has already been determined on the refractometer. Observations are made according to the following procedure:

I. EXAMINATION IN ORDINARY LIGHT.

(*a*) The color of the fragments in ordinary light is noted. Occasionally the general appearance of the substance may furnish some clue as to its identity.

(*b*) The general outline or shape, technically described as the crystal habit, is also recorded.

II. EXAMINATION IN PARALLEL POLARIZED LIGHT, NICOLS CROSSED.

(*Parallel polarized light is produced by inserting the crossed nicol prisms.*)

(*a*) The nature of the extinction of the material, whether parallel or inclined, is determined. This is arrived at by placing the long axis of a crystal parallel to one of the cross-hairs of the ocular. The angular reading on the stage is recorded. Then the crystal is turned to the point of maximum darkness. The reading on the stage is again recorded. If there is any difference between the two readings, the crystal has inclined extinction; otherwise parallel extinction. Several crystals are usually examined and an average of the results taken. In the tetragonal, trigonal, hexagonal and orthorhombic systems the extinction is normally parallel, as it is also, in some instances, in the monoclinic system. Crystals of the monoclinic and triclinic systems, however, usually show inclined extinction. Crystals belonging to the cubic system do not change from light to dark in parallel polarized light, but remain dark in all orientations.

(*b*) The sign of elongation is commonly determined as follows: A long and narrow crystal, showing very little color with nicols crossed, is so oriented that its long dimension is parallel to direction "*c*" of the selenite plate which is inserted in the slit provided for it in the microscope tube. (Direction "*c*" of the selenite is commonly indicated by an arrow engraved on the plate.) If the crystal appears blue (or green) in color, the elongation is positive; if the crystal appears yellow, white or gray, the elongation is negative.

III. EXAMINATION IN CONVERGENT POLARIZED LIGHT, NICOLS CROSSED.

(*Convergent polarized light is produced by bringing the substage condenser as close to the slide as possible and inserting the 4-millimeter objective.*)

(*a*) In order to determine the crystal system to which any crystalline fragment belongs, it is essential to determine the character of the extinction, whether parallel or oblique, and also to obtain some indications of what is known as an interference figure. In doubly refractive substances (*i. e.*, those which become alternately light and dark when the stage is rotated with nicols crossed), the interference figure shown may be uniaxial or biaxial. To obtain the best figures,

fragments of material should be chosen which remain dark or at most faintly illuminated during complete rotation of the stage. After locating and centering the grain to be examined, the ocular is removed and the nature of interference figure observed by looking through the microscope tube. In the case of a uniaxial crystal, a dark cross appears in the field, surrounded by rings, the figure remaining more or less stationary when the stage is rotated. A biaxial interference figure consists, in the ideal case, of two dark spots, surrounded by concentric rings, each dark spot being crossed by a curved black bar. If a uniaxial figure is shown and the extinction is parallel the indications are that the fragment belongs to either the tetragonal, hexagonal or trigonal system. A biaxial figure on a substance with parallel extinction, indicates the orthorhombic system, with inclined extinction either the monoclinic or triclinic system. (Crystals elongated in the direction of the *b*-axis show parallel extinction in the monoclinic system.)

(*b*) The optic sign is indicated as being positive or negative, as the case may be. It is determined by inserting the selenite plate and noting the change of color on opposite sides of the central cross of the interference figure. If areas of blue occur in a direction parallel to *c* of the selenite plate the sign is positive. If the color is yellow in that direction, the sign is negative.

IV. DETERMINATIONS OF THE REFRACTIVE INDICES OF THE SUBSTANCE.

In many instances the crystal system to which the fragment belongs may not be easily determinable, due to the difficulty encountered in obtaining good interference figures and also in positively determining the character of the extinction exhibited. Notwithstanding, other constants can be determined which are of value in proving the identity of the substance. Fortunately for the microanalyst, a great majority of the commonly occurring crystallizable inorganic chemical salts have been studied optically and at least sufficient data obtained on them to make their identification sure.

The most important optical constants which serve to identify a product with certainty are the refractive indices. These vary in number, depending upon the system in which the substance crystallizes. In crystals of the triclinic, monoclinic, and orthorhombic systems, three indices can be determined, the smallest being designated α, the intermediate β, and the largest γ. In those belonging to the hexagonal, tetragonal, and trigonal systems, two indices can be determined, ω and ϵ. Crystals belonging to the cubic system give but one index, indicated as n.

The fragment of material is immersed in the liquid on a slide, and examined under the microscope with one nicol prism in place; attention is then paid to the direction in which a band of light, which will be seen surrounding the fragment, moves when the tube of the microscope is raised. If the band of light passes into the crystal, it indicates that the refractive index in that crystallographic direction which chances to lie parallel to the plane of the nicol is higher than that of the liquid; if it passes out of the crystal the index of the liquid is higher than that of the crystal in that crystallographic direction. In other words, when the microscope tube is raised, the band of light passes toward that medium (either liquid or crystal) which has the higher index of refraction. When the crystal

(in any particular position) and the immersion liquid are of the same refractive index, the crystal fragment disappears completely in the liquid. Therefore the process is repeated with different liquids until the crystal completely matches the liquid, that is, no band of light passes either into or out of the crystal. A large number of fragments are examined until the analyst is convinced that the minimum, intermediate, and maximum indices in the case of the monoclinic, triclinic, and rhombic systems, or two indices in the case of the hexagonal, tetragonal, and trigonal systems, have been determined. Only one index can be determined for the cubic system. Two indices can be observed on any one fragment (if it has more than one), the index crosswise of an elongated crystal being shown when this crystal is perpendicular to the direction of vibration of the nicol, and the index lengthwise when the crystal is parallel to this direction.

Monochromatic Light.—The refractive index of a substance varies with the wave length of the light. It is customary to use the index for the *D*-line (sodium light) as the typical one for ordinary substances. For some purposes the average index, obtained by using white light, is sufficient. However, with some substances the band of light used for determining refractive indices is more or less separated into colored bands when white light is used, rendering the phenomenon difficult to observe. In general, therefore, the microanalyst should avail himself of some form of monochromatic light. This may be produced by using the light from a sodium flame, or by passing white light through some form of ray-filter. Wherry has recommended the use of a combination of Wratten *E*-red No. 23 and *B*-2 Extra Light No. 57-*A* filters, 3 inches square, in glass. It may be noted that the light transmitted by the yellow glass commonly used in automobile lamps is sufficiently monochromatic for most purposes.

EXAMPLE.

A sample was sifted through a 60-mesh sieve and the portion remaining on the sieve spread out upon a sheet of white paper for examination with a lens. Among the various fragments noted were small particles of a bluish color. One of these was removed to a slide, crushed, and a small drop of liquid added, the product then being examined in ordinary light.

I. EXAMINATION IN ORDINARY LIGHT.

The fragments were colorless and irregularly angular.

II. EXAMINATION IN PARALLEL POLARIZED LIGHT, NICOLS CROSSED.

(*a*) In parallel polarized light the colors exhibited by the majority of the particles were very striking. Some of the particles were more or less colorless.

(*b*) The particles were so irregular in shape that it was difficult to determine the extinction angle. Some particles more or less rectangular in shape indicated that the extinction was inclined.

(*c*) The sign of elongation could not be satisfactorily determined because of the nature of the material.

III. EXAMINATION IN CONVERGENT POLARIZED LIGHT, NICOLS CROSSED.

(*a*) One of the larger colorless fragments was located with the low power objective. The 4-millimeter objective was inserted and the substage condenser

brought into place. The particle was carefully centered. The eyepiece was removed and the stage slowly rotated. As the stage was rotated a distinct curved black bar passed into the field of vision and soon disappeared. The concentric rings already referred to were not very distinct but the curved bar was clearly a portion of a biaxial interference figure. The character of the extinction and the interference figure obtained indicated that the material belonged to either the monoclinic or triclinic system.

(*b*) Interference figure showing concentric rings was not observed, therefore the optic sign could not be determined with certainty.

IV. DETERMINATION OF THE REFRACTIVE INDICES.

A crushed fragment was immersed by way of preliminary trial in a liquid with a refractive index of 1.65. With the lower nicol in position, the band of light surrounding a large number of particles was found to pass from the crystal toward the liquid when the microscope tube was raised. This phenomenon was exhibited when the fragment was perpendicular to the vibration direction of the nicol as well as in the other position. It was apparent that the refractive index of the liquid was considerably higher than that of the crystal.

More material was immersed in liquid with index of 1.49. On raising the microscope tube, the band of light surrounding the crystal fragments passed into the crystals. This indicated that the index of refraction of the crystals was higher than that of the liquid, this being the case in every crystallographic direction noted.

Another fragment of the material was crushed and mounted in cedarwood oil which had an index of 1.515. Rotating the stage of the microscope then caused a large number of the irregular fragments to completely disappear. Examination of a large number of fragments indicated that no index was lower than 1.515.

Other fragments of the material showed an index appreciably higher than 1.515. The substance was immersed in liquid 1.540; many of the particles exactly matched this liquid. No index higher than 1.540 seemed to be present in the material. Evidently the minimum and maximum indices for the substance had been determined to be 1.515 and 1.540, respectively.

An intermediate index was indicated on irregular fragments showing very little color when the nicols were crossed. These particles when immersed in practically anhydrous clove oil with an index of 1.535, disappeared (as far as could be determined in monochromatic light). Confirmation of this fact by the examination of a large number of fragments determined the intermediate index to be 1.535.

Summarizing the data obtained, the following conclusions could be drawn concerning the identity of the substance in question. The biaxial interference figure and the inclined extinction indicated on the fragments suggested that the substance crystallized in either the monoclinic or triclinic system. This being the case, the three indices obtained could be indicated as follows: α: 1.515, β: 1.535, γ: 1.540. Reference to a table containing optical data of many of the commonly occurring crystallizable salts identified the substance as being copper sulphate, $CuSO_4.5H_2O$. This conclusion was further substantiated by studying some known material and comparing the results obtained with those character-

istic of the substance under examination. (In many instances microchemical tests are also of value for the purpose of verification.)

SUMMARY.

Attention has been called to the application of optical-crystallographic methods for the identification of crystallizable chemical salts in insecticides and fungicides. The author has found the use of such methods of value in many instances and has attempted to outline a simple method of procedure particularly suitable for microanalysts who have not had extensive training in crystallography and mineralogy.

No attempt has been made to go into detail concerning crystallographic and optical concepts, it being left to the reader to avail himself of these in works dealing primarily with petrographic methods.

THE DELICACY OF THE U. S. P. TESTS.

BY JOSEPH ROSIN.

By "delicacy" is here understood the quantity or proportion of the impurity examined for which will just fail of being detected. It is practically synonymous with "sensitiveness" and the two terms are used here interchangeably.

It is almost needless to state that in making the U. S. P. tests the directions of the Pharmacopoeia were closely followed. In several instances, however, deviations from the Pharmacopoeial instructions were necessary, and these are noted under the respective tests. Where the U. S. P. directions are not sufficiently explicit, the more explicit details given in the U. S. P. for testing other similar products for the same impurities were observed, or the established good practice in carrying out tests of this character was followed.

The materials used were the purest obtainable, or they were specially prepared. If they were not entirely free of the impurities to be tested for, the latter were determined and a correction applied in the final calculations of the results.

The method of procedure was the one generally employed in an investigation of this character. Solutions or mixtures of the pure material with varying proportions of the impurity to be tested for were subjected to the U. S. P. test or to the proposed test.

Before proceeding with the presentation of the results it will be well to note that in instances where the U. S. P. allows a slight turbidity or opalescence in the test, the results recorded are necessarily arbitrary, because, as it has been pointed out by others, the meaning of "slightly turbid" or "opalescent" is subject to various interpretations by observers. Even in the more definite tests where no manifestation of the presence of the impurity is allowed, somewhat divergent and occasionally very divergent results are obtained, because of differences in the manipulation of the test. For instance, in the majority of the U. S. P. tests it is simply directed to add the reagent to the solution or substance under examination without stating whether it should be mixed. True, the accepted practice is to mix the solution, but it is also true that not all mixings are equally effective. This is particularly the case when the quantities tested for are small and the time limit for the reaction is short. Other details in the manipulation, the diameter

of the test tube in which the test is made, as well as external conditions, such as illumination, temperature, etc., have a more or less definite bearing on the sensitiveness of the tests.

In this paper are recorded the results obtained with official acids. The sensitiveness of the U. S. P. tests for impurities in other official products is also being investigated and will be reported in due course. The percentage figures for sensitiveness given in this paper refer to ions.

ACETPHENETIDIN.

Acetanilid.—Material for this test was prepared by dissolving recrystallized acetphenetidin U. S. P. with varying proportions of acetanilid in a minimum quantity of hot alcohol and evaporating to dryness on a water-bath. The residue was powdered and well mixed.

The U. S. P. directs:

"Boil about 0.1 Gm. of acetphenetidin with 10 Cc. of water until dissolved, cool the solution, filter it, and add bromine T. S. to the filtrate, drop by drop, with agitation after each addition, until the solution remains permanently yellow; neither turbidity nor precipitation is produced."

The delicacy of the bromine-acetanilid reaction is approximately 1 in 5000. To attain this degree of sensitiveness it is necessary to let the mixture stand 15 minutes or longer before a turbidity will be noticeable. In the U. S. P. test it is understood that observation is to be made in 5 minutes after the addition of the bromine water. With this time limit the sensitiveness of the reaction is not greater than about 1 in 2000. Based on these facts the U. S. P. test should be delicate to about 4 to 5%. Experiments have proved this to be correct.

It is also quite evident that if a larger quantity of acetphenetidin be used with the same volume of water, the delicacy will be proportionally increased. Using 0.5 Gm., the test is rendered sensitive to about 1%—a sufficient degree of delicacy for the purpose of the U. S. P.

ACETIC ACID.

Formic or Sulphurous Acids.—In testing for these impurities the U. S. P. instructs to:

"Supersaturate 5 Cc. of the acid with 10 Cc. of ammonia water, add 5 Cc. of tenth-normal silver nitrate and boil the mixture for one or two minutes; no dark deposit is produced."

The delicacy of this test is about 1.5% for formic acid or 0.025% for sulphur dioxide. If, instead of supersaturation, the acid is neutralized with ammonia, which would require about 5 Cc., and boiled for 1 minute with 2 Cc. of silver nitrate, a delicacy of about 1% for formic acid is attainable.

Mercuric chloride is indeed a much more sensitive reagent for formic acid or sulphur dioxide than silver nitrate. On boiling 5 Cc. of acetic acid with 1 Cc. of a saturated aqueous solution of mercuric chloride for 2 minutes, a turbidity is produced when 0.08% formic acid or 0.001% sulphur dioxide is present. This test is, of course, too delicate for U. S. P. acetic acid.

ACID BENZOIC.

Cinnamic Acid.—Synthetic benzoic acid and the desired proportions of cinnamic acid were dissolved in a minimum quantity of warm ether, the solution

allowed to evaporate at room temperature and the residue of the acids powdered and well mixed.

The U. S. P. directions are:

"Warm 0.5 Gm. of the acid with 5 Cc. of distilled water and 0.5 Gm. of potassium permanganate in a loosely stoppered test tube, and place it in a water-bath heated to about 45° C. for ten minutes. Stopper the test tube tightly and allow it to cool. On removing the stopper, no odor of benzaldehyde is perceptible."

This test is delicate to about 2.5–3%. A greater degree of sensitiveness can be secured by "dissolving 0.5 Gm. of the benzoic acid in 20 Cc. of hot water and adding 2 Cc. of $\frac{N}{10}$ potassium permanganate to the hot solution." In the presence of 0.5% of cinnamic acid, a distinct odor of benzaldehyde will be perceptible.

ACID CITRIC.

Oxalic Acid.—The U. S. P. states:

"An aqueous solution of citric acid (1 in 10) which has been nearly neutralized with ammonia water remains clear on the addition of calcium sulphate T. S."

Calcium sulphate solution is not a suitable reagent for the detection of oxalic acid in citric. The degree of its sensitiveness for this test also depends on the quantity used, but the U. S. P. does not indicate how much to use. In applying the U. S. P. test to citric acid to which the equivalent of 7% of anhydrous oxalic acid has been added, when 5 Cc. of calcium sulphate was used, no turbidity was noticeable in 30 minutes. With 10 Cc. of calcium sulphate a turbidity was observed in 20 minutes. With 15 Cc. of calcium sulphate a slight turbidity was noticeable in 15 minutes. To attain a test delicate to about 0.5% oxalic acid, the following modification is suggested:

"Ten Cc. of the aqueous solution of the acid (1 in 10) is neutralized with ammonia water, then 5 drops of diluted hydrochloric acid added followed by 2 Cc. of calcium chloride T. S. and shaken; no turbidity is produced."

By increasing the amount of calcium chloride to 3 Cc., and allowing to stand for one hour, 0.25% oxalic acid is detectable, but a larger quantity of calcium chloride than this and longer standing will cause precipitation of calcium citrate.

Sulphuric Acid.—The sensitiveness of the U. S. P. test for this impurity is about 0.025%. When more than this amount is present a turbidity will be produced in 5 minutes.

Tartaric Acid.—The U. S. P. directs:

"Heat about 5 Gm. of powdered citric acid for 15 minutes on a water-bath with 5 Cc. of sulphuric acid in a porcelain dish, which has previously been rinsed with sulphuric acid, keep the mixture protected from dust; no darker color than yellow develops."

Pure citric acid yields with this test an orange-yellow or brownish yellow color, and no darker color was produced when 2–3% of tartaric acid was present. The fault in the U. S. P. test is that the quantity of sulphuric acid is too small.

The British Pharmacopoeia test for tartaric acid is:

"One Gm. of powdered citric acid mixed with 10 Cc. of sulphuric acid in a test tube previously rinsed with sulphuric acid acquires not more than a pale yellow color when kept at a temperature of 90° for one hour."

This method will detect with a fair degree of certainty about 0.5% tartaric acid.

The delicacy of the sulphuric acid test for tartaric acid is proportionate to the temperature at which the mixture is heated. If instead of 90° C. it is heated for one hour at 100° C. a delicacy of 0.25% is attainable. By heating a mixture of 0.5 Gm. citric acid with 5 Cc. of sulphuric acid in the flame of a Bunsen burner for one minute and comparing the color so produced with that of a blank with pure citric acid, Hill[1] detects as little as 0.01% of tartaric acid. With this process I have been able to confirm unmistakably the presence of 0.02% tartaric acid.

ACID HYDRIODIC DILUTED.

Barium.—The U. S. P. test is:

"The addition of one Cc. of potassium sulphate T. S. to 10 Cc. of the acid causes no turbidity."

The hydriodic acid available contained a trace of sulphate. The usual method for the determination of sensitiveness was therefore reversed. Ten Cc. portions of the acid were mixed with 1 Cc. of potassium sulphate solution and progressive quantities of a standard barium chloride solution added until the quantity required to yield a slight precipitate in 5 minutes was reached. A delicacy of about 0.002% was thus attainable. Longer standing than 5 minutes increases the delicacy by about 20–30%.

The U. S. P. potassium sulphate T. S. contains 1% potassium sulphate, corresponding to 0.087 normal. If 1 Cc. of half normal potassium sulphate is used the sensitiveness of the test is increased about threefold.

Chloride.—To test for chloride in hydriodic acid the U. S. P. directs:

"Mix 0.5 Cc. of diluted hydriodic acid with 10 Cc. of distilled water, add 8 Cc. of silver nitrate T. S. and 6 Cc. of ammonium carbonate T. S., digest the mixture for 10 minutes on a water-bath, cool, and filter. The filtrate, upon supersaturating with nitric acid, does not become more than slightly opalescent."

This test was found to be more sensitive than was anticipated. In the presence of 0.02% of Cl a decided turbidity results. Two brands of diluted hydriodic acid examined by the U. S. P. method showed no greater turbidity than corresponds to about 0.01% of Cl. It appears that 0.02% of Cl is an ample allowance for this impurity.

Sulphuric Acid.—In this test the U. S. P. allows a slight cloudiness. It is quite evident that the evaluation of "slight cloudiness" is very difficult, but from several experiments made with this test and submitted to several persons for their opinion, it seems that even a most liberal interpretation of "slight cloudiness" would not permit more than 0.01% sulphate.

ACID HYDROBROMIC DILUTED.

Barium.—The delicacy of this test is about 0.005%. As in the case of hydriodic acid, it is increased almost threefold by using half normal potassium sulphate instead of the U. S. P. solution.

Sulphuric Acid.—Here, too, the U. S. P. allows a slight cloudiness and it was shown that as little as 0.01% produces a very pronounced turbidity.

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[1] *Pharm J.*, 84, 245, 1910. Also Allen, "Com. Org. Anal.," Vol. IX, p. 114.

ACID HYDROCHLORIC AND ACID HYDROCHLORIC DILUTED.

Sulphuric Acid.—The U. S. P. test excludes more than 0.01% of sulphate in the diluted acid corresponding to 0.03% in the stronger acid.

ACID HYPOPHOSPHOROUS AND ACID HYPOPHOSPHOROUS DILUTED.

Barium.—The delicacy of the U. S. P. test for barium in the diluted acid is 0.0035% corresponding to 0.010% in the 30% hypophosphorous acid. It is likewise increased to almost three times as much when half normal of potassium sulphate is used.

NOTE.—Hypophosphorous acid of commerce usually contains some sulphate and therefore cannot contain any barium.

Oxalic Acid.—To test for this impurity the U. S. P. directs to:

"Neutralize the acid with ammonia, filter and add to filtrate calcium chloride; no turbidity should be produced."

Hypophosphorous acid U. S. P. always contains a little calcium; therefore, unless there is more oxalic acid present than is sufficient to combine with all the calcium, the oxalic acid will be entirely precipitated as calcium oxalate and none will be found in the filtrate, even though originally it was present.

With the following test a delicacy to less than 0.01% as anhydrous oxalic acid in the diluted acid can be attained:

"To 10 Cc. of the acid 1 Cc. of calcium chloride T. S. is added, then the solution made slightly alkaline with ammonia and 5 Cc. of glacial acetic acid added; a clear solution should result."

In the presence of more than about 0.01% of anhydrous oxalic acid a turbidity will be noticeable in 5 minutes or less. Moderate quantities of phosphoric acid and small amounts of iron do not interfere.

ACID LACTIC.

Glycerin.—The U. S. P. test is:

"Add 1 Cc. of lactic acid, in drops, to 5 Cc. of ether, shaking it after each addition; the ether solution does not become even transiently turbid."

This test will not show less than about 5% of glycerin when ether of about 0.715 sp. gr. is used. Absolute ether renders the test more delicate. It has also been noted that when sufficient glycerin is present to give a slight turbidity in the test, the turbidity will be formed when about 0.25 Cc. of the acid is added, but it disappears when one-half or all of the acid has been added.

In connection with the ether test for glycerin it might be well to mention the fact that small quantities of calcium or magnesium salts, not in excess of the amount permitted by the ash test, will also give a turbidity in the test and thus lead to an erroneous conclusion of the presence of glycerin. The test for glycerin was probably useful in the time when a chemical assay was a luxury, but now with a requirement of 85–90% acid strength and a suitable assay provided, the glycerin test could be very well omitted.

Oxalic, Phosphoric, and Tartaric Acids.—The U. S. P. test reads:

"No turbidity is produced on heating the acid with an excess of lime water."

This test is delicate to about 0.3–0.4% for oxalic acid and 0.5% phosphoric acid—

a delicacy sufficient for U. S. P. purposes; but it will not detect tartaric acid even when it is present to the extent of 10 to 15%. If a test for tartaric acid in lactic is desired, the following is suggested:

"Add 2 Cc. of potassium acetate solution (1 in 2) to 3 Cc. of lactic acid, shake for ten to fifteen seconds several times during 20 minutes and allow to stand for 15 minutes; no turbidity is noticeable."

In the presence of more than 0.5% of tartaric acid a turbidity, due to the formation of potassium bitartrate, will be formed. Allowing the mixture to stand over night, as little as 0.3% of tartaric will yield a turbidity.

Sugar.—The U. S. P. test is delicate to about 0.05% (as sucrose).

ACID NITRIC.

Sulphuric Acid.—"Diluted with 10 volumes of distilled water, it yields no precipitate upon the addition of barium chloride T. S." (U. S. P.)

This test is inexplicit, particularly in view of the fact that the nitric acid is supposed to be of a high grade of purity. The U. S. P. does not state how much barium chloride is to be added, and since no mention is made of the time at the expiration of which the observation is to be made, it is to be assumed that 5 minutes is the time limit as in other U. S. P. tests where no specific time is set.

Using 10 Cc. of the diluted acid and 0.3 Cc. of barium chloride T. S. and observing at the end of 5 minutes, the delicacy is well over 0.1%. With 1 Cc. of barium chloride the delicacy is about 0.1%.

As a matter of fact, nitric acid, U. S. P., contains much less sulphate than the U. S. P. test permits. The U. S. P. test is erroneous for the reason that the acid is insufficiently diluted, with the result that the relatively high concentration of acid prevents precipitation of barium sulphate. The following test, similar to that given under Acid Hydrochloric Diluted, is suggested:

"Mix 3 Cc. of the diluted acid (1 to 10 by volume) with 7 Cc. of water, add 1 Cc. of barium chloride and shake well. The liquid remains clear at the end of one hour."

This test is delicate to about 0.02% sulphate.

ACID PHOSPHORIC.

Hyphophosphorous or Phosphorous Acids.—The U. S. P. test for these acids is:

"Warm 5 Cc. of diluted phosphoric acid gently and add a few drops of silver nitrate T. S.; it does not become turbid or brown."

The delicacy of this test for hypophosphorous acid is 0.007% for the diluted acid, corresponding to 0.06% for the 85–88% acid.

If, instead of a few drops, 5 Cc. of silver nitrate T. S. is added to the acid and heated to about 80°–90°, the delicacy is increased five to six times. Also, if 1 Cc. of the stronger acid is warmed and 5 drops of silver nitrate added, 0.01% hypophosphorous shows a darkening in 5 minutes.

While the U. S. P. test is sufficiently sensitive for hypophosphorous acid, it is utterly inefficient for the detection of phosphorous acid. Even when as much as 1% of this acid was present in the diluted acid, no darkening was noticed. Increasing the quantity of silver nitrate to 5 Cc. rendered the test delicate to approximately 0.02% in the diluted acid, corresponding to 0.17% in the stronger acid—a striking illustration of the effect of larger quantities of reagents on the

sensitiveness of a test. If 1 Cc. of the 85% acid is heated with 5 Cc. of silver nitrate T. S. in a water-bath for 5 minutes, a sensitiveness of 0.01% is attainable.

U. S. P. phosphoric acid now available is entirely free of hypophosphorous or phosphorous acids.

Nitric Acid.—The U. S. P. test reads:

"Mix equal parts of diluted phosphoric acid and sulphuric acid and after cooling add a clear crystal of ferrous sulphate; no brownish color appears around the crystal."

The sensitiveness of this test is approximately 0.03% in the diluted acid, corresponding to 0.25% in the 85% acid—an abnormally large amount of impurity permissible by the U. S. P. test. Fortunately, the presence of even a much smaller quantity of nitric in 85% phosphorous will be manifested by the odor. If the U. S. P. test be applied directly to 1 Cc. of the 85% acid, the sensitiveness is 0.03%, thus reducing the permissible limit of nitrate $8^1/_2$ times in the 85% acid. Longer standing than 5 minutes is very beneficial in increasing the delicacy of the test. When allowed to stand for 10–15 minutes, the sensitiveness is increased twofold.

No U. S. P. phosphoric acid now available contains as much as 0.03% of nitric acid.

In the test for nitrate in sulphuric acid, the U. S. P. directs to "Overlay the acid with a solution of ferrous sulphate." The use of solution of ferrous sulphate is preferable to adding a crystal of ferrous sulphate as directed in the test for the same impurity in phosphoric acid. When a crystal of ferrous sulphate is used, the indications, in the presence of small quantities of nitrate, are indistinct and somewhat erratic, depending on the size and shape of the crystal. With solution of ferrous sulphate indications are sharp and uniform.

Phosphates.—This test is primarily intended for alkali and possibly also for alkaline earths, but since other U. S. P. tests do not exclude aluminium, it seemed advisable to determine the sensitiveness of the phosphate test for this element also.

The U. S. P. test is described under the diluted acid as follows:

"Evaporate 20 Cc. of diluted phosphoric acid to a volume of about 4 Cc. on a water-bath. Cool, transfer 2 Cc. to a graduated cylinder and add 6 Cc. of ether and 2 Cc. of alcohol; no turbidity appears."

In the present study the experiments were made with 2 Cc. of the 85% acid, as it was evidently not the intention of the U. S. P. when testing the stronger acid for phosphate to have it first diluted to 10% and then concentrated as described in the test. Because of the presence of less water in the 85% acid than in the acid obtained by concentration of the diluted acid, the sensitiveness of the test for phosphate is greater when made directly with the stronger acid.

Aluminium.—The delicacy of the test for aluminium is about 0.25% Al, corresponding to a little over 1% aluminium phosphate ($AlPO_4$). When the ether is added, a turbidity is produced even when less aluminium is present, but it clears up on the addition of the alcohol. Doubling the quantity of ether-alcohol increases the sensitiveness of the test about two times.

Calcium.—When calcium (Ca) is present in excess of 0.1%, corresponding to nearly 0.3% calcium phosphate ($Ca_3(PO_4)_2$), a turbidity will be produced in the test. When twice as much ether-alcohol is used, a turbidity will be produced when 20–30% less calcium is present.

Sodium.—The test is sensitive to approximately 0.15% sodium (Na) corresponding to 0.5% sodium phosphate (Na_2HPO_4). As noted under aluminium, doubling the quantity of ether-alcohol increases the sensitiveness twofold.

Sulphuric Acid.—The delicacy of this test is approximately 0.015% for the diluted acid, corresponding to 0.13% for the 85% acid.

SULPHURIC ACID.

Lead.—The U. S. P. test for lead, requiring that "no precipitate is formed within an hour on mixing sulphuric acid with 4 or 5 volumes of alcohol," is delicate to 0.0003–0.0004% Pb. When 0.0005% Pb is present, a distinct turbidity is produced within 15 to 20 minutes.

Nitric Acid.—A sensitiveness of about 0.003% is attainable by the U. S. P. test.

TARTARIC ACID.

Oxalic Acid.—The delicacy of the U. S. P. test for oxalic in tartaric acid depends on the quantity of calcium sulphate solution used, but the U. S. P. does not state how much to use.

In experiments with the U. S. P. test made with tartaric acid to which the equivalent of 1% of anhydrous oxalic acid was added and using 5 Cc. of calcium sulphate T. S. no turbidity was noticeable in 30 minutes. With 10 Cc. of calcium sulphate the same acid showed a faint turbidity in 5 minutes. When tartaric acid containing 0.8% anhydrous oxalic acid was tested with 10 Cc. of calcium sulphate T. S., a faint turbidity was noticeable in 8–10 minutes. Therefore, using 10 Cc. of calcium sulphate, a delicacy of approximately 0.8% of anhydrous oxalic acid is attainable. If the mixture is allowed to stand for a longer time, the delicacy is increased, but too long standing will cause precipitation of calcium tartrate.

If a greater degree of sensitiveness is desired, the following procedure may be used to advantage:

> Five Cc. of the aqueous solution of the acid (1 in 10) is neutralized to litmus with 10% ammonia water, then another portion of 5 Cc. of the same solution of the acid is added, the mixture well shaken, cooled to 15° C. and filtered. The filtrate is nearly neutralized with ammonia and an equal volume of calcium sulphate solution added.

With this method the delicacy of the test will be raised to about 0.3% anhydrous oxalic acid.

Sulphuric Acid.—The sensitiveness of the U. S. P. test for this impurity is approximately 0.025%.

The U. S. P. purity standards for hydrochloric acid (31–33%), hypophosphorous (30–32%), phosphoric (85–88%), and sulphuric acid (93–95%) are based on the tests for the corresponding diluted acids, the U. S. P. making the statement that, for instance, "sulphuric acid conforms to the tests for identity and purity as given under Acidum Sulphuricum Dilutum when diluted to that strength."

The wisdom of this policy for the standardization of the stronger acids is very questionable. Very few, if any, of the users of acids purchase the diluted acids. The stronger acids are the staple of commerce. The weaker acids are made by the consumer, when required, by diluting the stronger. It would therefore seem to be more to the point to have the purity standards established for the acids which are being bought and sold—the stronger acids. If the stronger acids are pure their dilutions with distilled water must also be pure.

The stronger acids should be standardized on their own merits, and independent of the standards for the diluted acids; for, as a result of the present arrangement, acids of inferior quality will meet the U. S. P. specifications. For instance, the U. S. P. allows 0.006% of non-volatile in diluted sulphuric acid, consequently the stronger acid containing 94% of H_2SO_4 may have 9.4 times as much or 0.05% of non-volatile—a very inferior acid indeed. This condition obtains also with regard to several other impurities as has been pointed out in the discussion of the respective tests.

A summary of the delicacy of the tests considered in this paper is presented in the following table:

Substance tested.	Impurity tested for.	Delicacy of U. S. P. test.	Delicacy of suggested test.
Acetphenetidin	Acetanilid	4–5%	1%
Acid Acetic	Formic acid	1.5%	
	Sulphur dioxide	0.025%	
Acid Benzoic	Cinnamic acid	2.5%–3%	less than 0.5%
Acid Citric	Oxalic	over 7%	0.5%
	Sulphuric	0.025%	
	Tartaric	.....	0.5%
Acid Hydriodic, diluted	Barium	0.002%	
	Hydrochloric	0.02%	
	Sulphuric	at most 0.01%	
Acid Hydrobromic, diluted	Barium	0.005%	
	Sulphuric	at most 0.01%	
Acid Hydrochloric	Sulphuric	0.03%	
Acid Hydrochloric, diluted	Sulphuric	0.01%	
Acid Hypophosphorous	Barium	0.010%	
	Oxalic	.....	0.03%
Acid Hypophosphorous, diluted	Barium	0.0035%	
	Oxalic	.....	0.01%
Acid Lactic	Glycerin	about 5%	omit test
	Oxalic	0.35%	
	Phosphoric	0.5%	
	Tartaric	.....	0.5%
	Sugar	0.05%	
Acid Nitric	Sulphuric	over 0.1%	0.02%
Acid Phosphoric	Hypophosphorous	0.06%	
	Nitric	0.25%	0.03%
	Phosphates:		
	Aluminium	0.25% (Al)	
	Calcium	0.1% (Ca)	
	Sodium	0.15% (Na)	
	Phosphorous	over 8%	0.01%
	Sulphuric	0.13%	

Substance tested.	Impurity tested for.	Delicacy of U. S. P. test.	Delicacy of suggested test.
Acid Phosphoric, diluted	Hypophosphorous	0.007%	
	Nitric	0.03%	
	Phosphorous	over 1%	0.02%
	Sulphuric	0.015%	
Sulphuric Acid	Lead	0.0003–0.0004%	
	Nitric	0.003%	
Tartaric Acid	Oxalic		0.8%
	Sulphuric	0.025%	

LABORATORY POWERS-WEIGHTMAN-ROSENGARTEN CO.,
PHILADELPHIA, PA.

THE CHEMISTRY OF MILK CURD MODIFICATION IN INFANT FEEDING.*

BY ROBERT WOOD TERRY.

INTRODUCTION.

The specific intent of this article is an endeavor to explain in chemical terms the action of certain substances commonly used in artificial infant feeding to modify the character of milk curds. While medical literature has given this subject due consideration from a practical and clinical standpoint, the writer has been able to find but little theoretical explanation for the action of these substances. The data presented in this paper are based on experiments *in vitro;* the deductions and recommendations are purely theoretical and are not presented as clinical facts. For years physicians have been adding certain substances to milk to modify the character of the curds and their experience has unmistakably shown that these substances have a beneficial action. However, this knowledge has been almost wholly empirical and it is thought that the presentation of certain theoretical facts concerning the action of these substances will help to place their use on a more logical and satisfactory basis. The suggestions regarding the use of certain substances are based only on their action as milk curd modifiers. For instance, under alkalies where certain quantities of lime water are suggested, this is done with absolute disregard of the controversy as to the necessity or advisability of the addition of more calcium to the infant's food or to its effect on fat metabolism. In this connection, as Brennemann remarks, "The ultimate test of any therapeutic measure in infant feeding is the baby himself, the living, clinical, digesting baby that often laughs at our theories and weeps over our science."

THE OBJECT OF MODIFICATION.

The object of modifying the character of the milk curds is due to the great difference in the physical condition of these curds as obtained from human milk and cows' milk. The curd from human milk is flocculent and each individual curd is very small and in the aggregate resembles extremely fine cottage cheese in a watery condition. When cows' milk is coagulated under the same conditions it forms in three or four large curds. In human milk, where the curd

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* Read at February meeting, Northern Ohio Branch, A. Ph. A.

is flocculent, the gastric juice can permeate all through the curd and can form hydrochloric acid-casein, in which form the casein is digestible, and, due to the antiseptic action of the gastric juice, it will be able to arrest bacterial activity and lactic acid fermentation. It is axiomatic that the more surface exposed to the gastric juice the more rapid and thorough will be the performance of its proteolytic functions.

When, through some misfortune, it becomes necessary to deprive an infant of its mother's milk, it is then necessary to feed the infant artificially; the most commonly used and logical substitute being cows' milk; and, because of the great differences, particularly in the curds of the two milks, it becomes necessary to so modify the cows' milk that the infant can digest it properly. Nature intended an infant to obtain its nutrition from milk the same as a calf, but it certainly expected it to obtain it in a different physical condition, as is evidenced by the differences in the curds formed under identical conditions and the more diverse difference in the anatomy of the stomachs of the two offspring.

CHEMISTRY OF MILK COAGULATION.

One of the most disputed questions in milk chemistry is whether the caseins from the two milks are identical. This question has arisen from the difference in the physical properties of the curds from the two milks. At the present time the weight of scientific opinion seems to indicate that they are identical and that the difference in the curd formation is due to other concomitant factors, such as the concentration of the caseinogen, acidity of the precipitation medium, the ratio of caseinogen to lactalbumin, the ratio of calcium to citric acid in the milk, etc. The casein from human milk when properly purified has the same nitrogen, phosphorus and sulphur content; the same degree of valency; gives the same series of salts with bases; has the same molecular weight; and is acted upon in the same manner as the casein from cows' milk.[1]

Considerable confusion exists as to the difference in the terminology of casein products used by various writers and it becomes almost imperative that each writer give a key to his articles. The product precipitated from milk by acids is termed *casein;* this term is also used in a collective or general sense. The mother substance of the curd exists in milk in colloidal suspension and is called *caseinogen.* The rennin transformation product is termed *paracasein.* The curd produced by the combined action of calcium and magnesium ions on paracasein (the normal milk curd) is termed *calcium paracaseinate.* While the term magnesium paracaseinate would be equally applicable here, it seems that the literature speaks only of the calcium salt, so that term will be used throughout this article. Rennin is a proteolytic enzyme found in the stomachs of human beings and some animals, and its only function appears to be that of curdling milk. Rennin from the calf's stomach is termed *chymosin,* while that from the human stomach is termed *parachymosin.* These two substances are very similar in action but not identical. All rennin referred to in this article will be *chymosin.*

The coagulation of milk in the stomach is practically identical to its coagulation in the test tube. The time noted for the following changes that take place are those of test-tube observation, but are approximately correct for the stomach. Cows' milk appears to coagulate in the stomach in from three to five minutes.

When milk is taken into the stomach and comes in contact with the gastric juice containing the enzyme rennin, the milk immediately begins to undergo a change, the rapidity of which is dependent upon the temperature and concentration of the rennin and caseinogen. This change is not macroscopically noticeable. In about four or five minutes the viscosity of the milk begins to increase to a noticeable extent, and in a few seconds it will be so viscous that it will not flow; in another few seconds, small curds begin to appear. In an additional few seconds, these small curds begin to cohere to form several large curds. In from three to five minutes these curds start to expel the whey by contraction. In this condition the curds are semi-rubbery and occupy a large percent of the original volume of the milk. The expulsion of the whey probably eliminates the bulk of the gastric juice which might happen to be enclosed when the curds first form. This is the end of coagulation and digestion proper then commences.

The coagulation of milk is accomplished by two distinct factors. The first is the proteolytic action of rennin, that is, the conversion of caseinogen to paracasein. Caseinogen exists in milk in colloidal suspension as submicrons at the rate of from three to six billions per cubic centimeter, and appears to be combined with calcium phosphate.[2] According to Van Slyke & Bosworth,[3] caseinogen is an octobasic acid and appears to exist in milk as calcium caseinogenate (caseinogen Ca_4). Neutral dicalcium phosphate also appears to be colloidally suspended. In whatever condition caseinogen exists in milk it is changed by rennin to paracasein, which substance is insoluble in the presence of sufficient calcium and magnesium ions. The velocity of this rennin activity is probably not affected by any ordinary change in the degree of acidity of the medium.[4] Paracasein in the presence of sufficient calcium or magnesium ions flocculates into curds. When the calcium and magnesium ions are diminished beyond a certain extent the paracasein remains in solution or suspension. The change of caseinogen to paracasein is independent of the presence or absence of calcium or magnesium ions. Experiment No. 1, which is essentially Hammarsten's[5] famous experiment, will clearly demonstrate the function and independent action of rennin and calcium and magnesium ions.

Experiment No. 1.—Two equal sized samples of cows' milk are placed in flasks in a water-bath and heated to 38.5 C., which temperature is maintained throughout the experiment. To one flask is added a certain amount of ammonium oxalate solution, which precipitates all the soluble calcium as insoluble calcium oxalate. Then to each flask is added an equal amount of fresh rennin solution. In about five minutes the flask holding the unaltered milk will be coagulated. Allow the other flask to remain in the bath for an additional thirty minutes to demonstrate that no coagulation will take place, then boil this milk to destroy the rennin, and add a few drops of a solution of calcium chloride; immediately a precipitate of calcium paracaseinate is produced, showing that the presence of calcium is essential for the coagulation of milk. From this experiment it will be seen that rennin is not a coagulating enzyme, but that it is a proteolytic enzyme and that the calcium is the substance that produces the coagulation. This same effect can be produced by a solution of magnesium chloride.

If the same number of paracasein particles and calcium and magnesium ions are confined in a space smaller than that of the original space and all particles in motion, it is evident that the chances of a union between the particles is greater in any given interval; and if the space be increased over the original, the chances of a union will be less in the same interval. In other words, this is the principle

of the law of mass action—that the speed of a reaction is proportional to the concentration of the active masses. This is a very important fact in milk curd modification. It has been shown by Brennemann[6] that nascent calcium paracaseinate (true milk curds) has a very powerful coalescing property but this property rapidly disappears. This means that if a certain number of colloidal particles of calcium paracaseinate are formed rapidly there will be a large number of collisions while they are comparatively nascent and having powerful coalescing properties and under these conditions large aggregates are possible. If this same number of colloidal particles are slowly liberated in the same volume, it is evident that collisions will not take place so often, but when they do take place, it will be when one or more of the particles or aggregates has lost to a great extent its coalescing power and by deduction from the natural frequency of coincidence, no large aggregates are possible. Therefore, anything added to milk which delays the formation of calcium paracaseinate is a milk curd modifier because of the rapidly fleeting power of the curds to coalesce. It may be stated that the specific action of coagulation of calcium or magnesium ions on paracasein is due to the ion giving the colloidal particle temporary cohesive properties.

The following procedures are in use for modifying milk curds and are listed, not in the order of their importance, but in the most logical sequence of their presentation:

1. Dilution with water.
2. By the use of gruels and carbohydrates.
3. By boiling the milk.
4. By the use of citrates.
5. By the use of alkalies.

DILUTION WITH WATER.

The theory of the action by simple aqueous dilution is based on the concentration of the active masses—the more dilute, the more slowly are the colloidal particles formed and, as explained before, they then have less coalescing power and hence numerous small curds are the result. The effect on the velocity of coagulation by dilution is given in Experiment No. 2.

Experiment No. 2.—

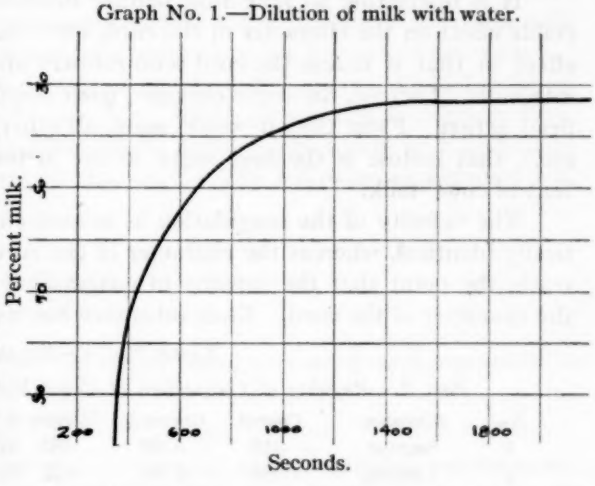
1. 100% milk coagulated in 345 seconds.
2. 75% milk coagulated in 380 seconds.
3. 50% milk coagulated in 655 seconds.
4. 33% milk coagulated in 2100 seconds.
5. 25% milk uncoagulated after 2 hours.
6. 12½% milk uncoagulated after 2 hours.

Tests No. 1 and No. 2 gave normal coagulations. While No. 3 coagulated, it was not quite complete, the whey being slightly milky. Small flakes of calcium paracaseinate appeared in test No. 4 in about thirty-five minutes, but after 2 hours only about 10% seemed to be precipitated. The addition of 1 mil of about a five percent solution of calcium chloride to tests Nos. 4, 5 and 6 (200 mils each) produced, immediately, beautiful floccules of calcium paracaseinate.

This data is plotted in Graph No. 1. Here it will be noted that relatively little delay is occasioned unless the milk occupies about fifty percent or less of the volume of the mixture. Obviously this type of modification cannot be practiced without limit, because of the capacity of the infant's stomach. This method

produces a curd of very desirable properties. The time noted here for coagulation may not be the same as in the stomach, but the ratio of time to effect is the same.

Graph No. 1.—Dilution of milk with water.



Brennemann[7] has studied the coagulation of milk, plain and modified by various substances, in the stomach, and his contribution is very comprehensive and conclusive in experimental detail and results. He obtained the cooperation of a young adult who could empty the stomach of its contents by "digital irritation of the fauces." This meant delivery of the stomach contents in their actual condition, something that is not true by the use of emetics or the stomach pump. Brennemann's numerous experiments covered practically everything used for milk curd modification and it is most interesting to note that in no case except lactose, where his conclusions were drawn from inference and not experiments, did his conclusions differ from the writer's, wherein all experiments were performed in "test tubes" and mechanical stomachs.[8] Brennemann's conclusion regarding diluted milk is, "The size of the curds varies inversely as the dilution, or directly as the amount of casein."

GRUELS AND CARBOHYDRATES.

The substances from which gruels are commonly made are wheat flour, barley flour, rolled oats and, occasionally, rice and arrowroot. In these gruels the starch is present in the gelatinous or colloidal state—the only condition in which it is capable of modifying the curd. Its action is entirely mechanical, that of interference as a protective colloid, and its effectiveness is proportional to the amount of gelatinized starch present.

In some cases dextrinized gruels are used; these are prepared by adding some form of liquid diastase to the gruels to convert the starch to dextrins and maltose. In this condition the "starch" is more readily assimilated but unfortunately it has lost its effectiveness and is unable to perform the function intended of it.[9]

One manufacturer of an infant food states that when milk is modified with his product the curd formed occludes about thirty percent of the food and that this being rather soluble it is rapidly removed from the curd structure, leaving it porous. This statement has not been affirmed or denied. Brennemann's experiments on carbohydrates were allowed to remain in the stomach only from thirty to sixty minutes and his conclusions are, "Starch concoctions very radically influence the coagulation of milk in the stomach. Carbohydrates, dextrose, milk sugar, cane sugar and maltose have no appreciable influence."

Sugars have practically no effect on the rapidity of curd formation. Table

No. 1 shows the rapidity and physical condition of curd formation in milk to which various sugars have been added.

It is interesting to note that neither dextrose nor maltose have any appreciable effect on the character of the curd, while sucrose has a decided detrimental effect in that it makes the curd semi-rubbery and comparatively difficult to disintegrate. Lactose, the sugar obtained from cows' milk, has a very decided beneficial action. From this, it would seem, all other conditions being equal (purity, etc.), that lactose is the best sugar to use in increasing the carbohydrate content of cows' milk.

The velocity of the coagulation as influenced by sucrose and lactose is practically identical, whereas the character of the curds is very different. This illustrates the point that the *rapidity* of coagulation is not the *only* factor affecting the character of the curd. Each substance has its specific action on the character

TABLE NO. 1.—SUGARS.

Part A.—Rapidity of Coagulation of Cows' Milk as Influenced by Sugars.

No.	Substance.	Control.	Grammes.	Seconds to coagulate.			Average.	Percent.
1	Sucrose	343	5.00	380	374	365	373	108.7
2	Lactose	388	5.00	422	415	413	416.7	107.4
3	Dextrose	390	5.00	407	397	405	403	103.3
4	Maltose[1]	355	5.00	302	295	300	299	84.2

Part B.—Effect on the Physical Condition of the Curd by the Sugars from A.

No.	Substance.	Macroscopical condition of the coagulum.
	Controls	Fairly smooth and fairly easily disintegrated.
1	Sucrose	Smooth and semi-rubbery.
2	Lactose	Semi-flocculent and very easily disintegrated.
3	Dextrose	Fairly smooth and fairly easily disintegrated.
4	Maltose	Smooth, but not so easily disintegrated.

NOTES.—Control test is plain cows' milk; the number under "Control" is the number of seconds to coagulate the control test, or 100%.

Each test consisted of 200 mils of cows' milk to which 5 mils of 0.5% rennin solution was added. Rennin 1–30000.

Temperature 37–39° C.

Each test bottle was given a slight inverted motion to simulate in a manner the peristaltic movements of the stomach.

[1] The apparent accelerating action of the maltose is probably due to calcium salts; most samples contain calcium, but before this could be substantiated the sample was accidentally destroyed. This matter will be cleared up at some future date.

of curd formation independent of all other actions. However, it may be stated that, *all other conditions being identical, the character of the curd is dependent upon the rapidity of its formation.* "The solidity of a curd produced by rennet is inversely proportional to the length of time occupied by the coagulation process."[10]

BOILING.

Boiling milk decidedly affects its coagulation; the curds form slowly and are very flocculent and easily digested. It has been shown[11] that rennin coagulation in milk previously heated to 70° C. and cooled, is not delayed; but if the milk is heated beyond this temperature, delay in coagulation occurs somewhat in proportion to the degree of heat and the length of exposure. This has been attributed

to milk enzyme destruction which happens to commence at about 70° C., but from experiments conducted, the writer is led to believe that milk enzymes have nothing to do with coagulation. The writer noticed that the formation of scum on milk commences at about 70° C. Certain factors increase the amount of scum formation, such as the degree of heat, length of exposure and movement of the liquid which presents new surfaces to the air, etc. Milk scum is rich in calcium salts, so that it would seem that the retarding effect on the coagulation of milk by boiling is due to the removal of calcium in the scum. The following experiment will demonstrate these facts.

Experiment No. 3.—

1. 200 mils milk, 5 mils rennin solution, 38.5° C.
   Coagulated in 380 seconds.
   Curd normal.
2. 200 mils milk, boiled for 10 minutes and rapidly cooled; strained through cheesecloth; 5 mils rennin solution, 38.5° C.
   Coagulated in 1720 seconds.
   Finely flocculent.
3. 200 mils milk, heated as above with about 0.10 gramme calcium chloride in solution added after cooling; 5 mils rennin, 38.5° C.
   Coagulated in 255 seconds.
   Semi-rubbery.

This removal of calcium salts by the scum causes a slower coagulation due to the decrease in the concentration of calcium and if approximately this amount of calcium is added, coagulation takes place normally.

It is evident from these facts that *correctly* pasteurized milk will coagulate in the same time as raw milk.

Boiling the milk reduces its potential acidity from eighteen degrees to fourteen degrees. This is due principally to the loss of dissolved carbon dioxide.

CITRATES.

Citrates are employed very extensively in England for modifying curd formation but their use is rather limited in America. The effect is all that could be desired of a milk curd modifier, and there can be no objection to their use on the grounds of introducing a foreign substance to the milk, as citrates are normal constituents of both human and cows' milk.

Jerome Alexander[12] explains the action of sodium citrate as a protective colloid and states that "when going into solution actually exhibits actively moving ultramicrons in the ultramicroscope, a fact which indicates its colloidal condition."

Another theory that has been advanced is that the citrate reacts with the hydrochloric acid of the gastric juice to form sodium chloride and citric acid which is a comparatively weak acid in relation to hydrochloric. Since the effect of citrates are observable in test-tube experiments where neither gastric juice nor hydrochloric acid is present, obviously this is not the explanation for their action.

The theory that is proposed by Van Slyke and Bosworth[13] is: "The addition of sodium citrate to normal milk increased the amount of soluble calcium in the milk, this increase resulting from a reaction between the calcium caseinate

of the milk and sodium citrate, by which is formed sodium caseinate (or calcium sodium caseinate) and calcium citrate. The reaction is reversible."

According to their theory, it is the calcium paracaseinate which is insoluble or when it is formed the milk coagulates. Calcium paracaseinate (Ca_2 paracasein) is insoluble and is the normal milk curd. Sodium paracaseinate (Na_4 paracasein) and calcium-sodium paracaseinate ($CaNa_2$ paracasein) are soluble by reason of the sodium they contain. When the amount of sodium becomes less than that present in calcium-sodium paracaseinate, the paracasein compound becomes insoluble and coagulation becomes possible.

If this theory were correct, we would expect a citrate to entirely prevent coagulation if it retarded it at all, because the sodium which renders the compound soluble should be active for any reasonable length of time. Experiments show that this is not the case. Also, if it is the sodium of the sodium citrate which renders the paracasein compound soluble, why would not any sodium salt have the same effect?

Table No. 2 shows the effect on the rapidity of coagulation of milk by the use of citrates, acetates, tartrates and chlorides of sodium and potassium, and it will be seen here that the citrates are the only salts that have any marked influence on the rate of coagulation. Any marked difference in the degree of ionization of two calcium salts would cause the equilibrium to be established wherein

TABLE NO. 2.—ALKALI SALTS OF ORGANIC ACIDS AND CHLORIDES.

Part A.—Rapidity of Coagulation of Cows' Milk as Influenced by Acetates, Chlorides, Citrates and Tartrates.

No.	Substance.	Control.	Grammes.	Seconds to coagulate.			Average.	Percent.
1	Potassium Citrate	254	0.100	389	370	375	378	148.8
2	Sodium Citrate	305	0.100	478	460	480	472.7	155
3	Potassium Acetate	390	0.100	395	390	397	394	101
4	KNa Tartrate	372	0.100	380	380	390	383.3	103
5	Sodium Chloride	270	1.00	315	315	315	315	116.7
6	Potassium Chloride	345	1.00	370	370	365	368.3	106.7
7	Calcium Chloride	280	1.00	50	52	58	53.3	19
8	Magnesium Chloride	282	1.00	101	119	103	107.7	38.1
9	Ammonium Chloride	285	1.00	265	273	283	273.7	96

Part B.—Effect on the Physical Condition of the Curd by Acetates, Chlorides, Citrates and Tartrates.

No.	Substance.	Macroscopical condition of the coagulum.
	Controls	Fairly smooth and fairly easily disintegrated.
1	Potassium Citrate	Fairly smooth and fairly easily disintegrated.
2	Sodium Citrate	Slightly flocculent and easily disintegrated.
3	Potassium Acetate	Coarse and rubbery.
4	KNa Tartrate	Fairly smooth and fairly easily disintegrated.
5	Sodium Chloride	Fairly smooth and semi-rubbery.
6	Potassium Chloride	Smooth and fairly easily disintegrated.
7	Calcium Chloride	Smooth and fairly easily disintegrated.
8	Magnesium Chloride	Smooth and rubbery.
9	Ammonium Chloride	Smooth and semi-rubbery.

NOTES:—

For general notes Table No. 1.

Calcium chloride refers to $CaCl_2.2H_2O$. Magnesium chloride, $MgCl_2.6H_2O$.

Whey expulsion from the potassium chloride tests was slow.

the one case there would be more available calcium than in the other. The equilibrium of a reaction is always shifted towards the formation of the slightly ionized compound.[14] If the calcium chloride formed by the equilibrium after the addition of sodium chloride is ionized to a greater extent than the calcium citrate formed by the rearrangement after the addition of sodium citrate, then less sodium would be available for combination with the caseinogen. It does not seem reasonable, however, that this theory alone would explain the marked difference in the action of these two salts.

The writer's theory of the action of citrates is based on the fact that solutions of calcium citrate are but slightly ionized[15] and that if sodium or potassium citrate is added it combines with the bulk of the available calcium to form the slightly ionized calcium citrate; this means a diminution of calcium-ions by fixation, and the concentration of one of the active masses is thereby reduced and hence coagulation takes place more slowly. This demonstrates that it is the calcium-ion that is active in coagulation and that molecular calcium such as calcium citrate has but little effect on coagulation. As far as availability for coagulation is concerned it might as well be precipitated out of solution. This theory explains every known condition of the action of citrates in experimental work and is in harmony with the theoretical action of all other modifying agents.

By examination of Table No. 2 it is noted that sodium citrate has slightly greater retarding power than the potassium salt. The sodium salt contains more citrate radical per gramme than the potassium salt, but the ratio is greater than their retarding action on coagulation. Potassium acetate has practically no retarding influence on coagulation yet the curd is coarse and rubbery; here again is the specific action probably of the acetate radical. The tartrate has apparently no action and the chlorides of potassium and sodium have little retarding effect, although sodium chloride had a slight detrimental effect on the character of the curd. Both calcium and magnesium chlorides greatly accelerated the coagulation. The calcium chloride acted about twice as fast as the magnesium chloride, but the curd produced was not very much different from the control milk curd, while the magnesium chloride curd had very undesirable properties. This would indicate that the specific action of calcium salts is far better than that of magnesium salts on the physical condition of the curds.

Citrates slightly reduce the potential acidity of the milk; this is due to the increased solubility of calcium phosphate in citrate solutions or to the formation of sodium phosphate which hydrolyzes alkaline.[4]

The addition of two grains of sodium citrate to the ounce of milk, which is the proportion usually recommended, will prevent practically all coagulation of milk in the stomach.

Brennemann's conclusions in regard to the action of citrates are that "sodium citrate has a very marked influence on casein coagulation, both delaying and altering it."[7]

ALKALIES.

Of all the methods used for curd modification, alkalies have by far been given preference. In this connection, Brennemann has aptly stated that "It is gratifying to note that a procedure that has enjoyed so many years of confidence should

seem to have a rational as well as an empirical basis."[7]

About the only statement explaining the action of alkalies that the writer can find in medical literature is that they reduce the acidity of the milk. This is certainly true, but it is an indirect statement and not an explanation. All alkalies act by precipitating calcium salts[16] and when precipitated they are not capable of reacting with the paracasein and we have a reduction of potential calcium ionization or available calcium. The alkalies generally employed are sodium and potassium bicarbonates, milk of magnesia and lime water.

Sodium Bicarbonate.—This substance, although formerly used extensively, has of late years fallen into disuse. For the quantitative effect of sodium bicarbonate and other alkalies see Table No. 3. It will be noted that on the same alkalinity basis sodium bicarbonate has less retarding effect than any of the

Experiment No. 4.—

1. 200 mils milk, 5 mils rennin solution at 38° C.
   Coagulated in 450 seconds.
   Curd—normal.
2. 200 mils milk, saturated with carbon dioxide by passing the gas in a steady stream through the milk; chilled by ice for 20 minutes just previous to coagulation; 5 mils rennin solution at 38° C. Coagulated in 90 seconds.
   Curd—small and rubbery.

Further verification of this action can be noted by just neutralizing a weak solution of calcium hydroxide (sucrose) with phosphoric acid; phenolphthalein as indicator; chilling this moderately and passing a stream of carbon dioxide through this magma; filtering and passing a stream of carbon dioxide-free air through the filtrate; in a few minutes the filtrate will become cloudy due to the precipitation of calcium phosphate by the removal of the loosely held carbonic acid.

TABLE NO. 3.—HYDROXIDES AND BICARBONATES.

Part A.—Rapidity of Coagulation of Cows' Milk as Influenced by Hydroxides and Bicarbonates.

No.	N. O. 100 V. S.	Control.	Mils.	Seconds to coagulate.			Average.	Percent.
1	Sodium Hydroxide	378	7.46	920	928	925	924.3	244.5
2	Potassium Hydroxide	376	7.46	975	965	950	963.3	256.2
3	Ammonium Hydroxide	380	7.46	903	865	880	882.7	232.3
4	Magnesium Hydroxide[2]	367	7.46	640	625	630	631.7	172.1
5	Calcium Hydroxide	291	16.43[1]	448	443	440	443.7	152.4
6	Sodium Bicarbonate	345	7.46	425	418	423	422	122.3
7	Potassium Bicarbonate	400	7.46	502	515	502	506.3	126.6

[1] Equivalent to 7.46 mils N. O. 100 V. S.

[2] Magnesium hydroxide in suspension.

Solutions standardized with methyl-orange as indicator.

Part B.—Effect on the Physical Condition of the Curd by Hydroxides and Bicarbonates.

No.	Substance.	Macroscopical condition of the coagulum.
	Controls	Fairly smooth but not so easily disintegrated.
1	Sodium Hydroxide	Semi-flocculent and very easily disintegrated.
2	Potassium Hydroxide	Semi-flocculent and very easily disintegrated.
3	Ammonium Hydroxide	Semi-flocculent and very easily disintegrated.
4	Magnesium Hydroxide	Fairly smooth and fairly easily disintegrated.
5	Calcium Hydroxide	Fairly smooth and fairly easily disintegrated.
6	Sodium Bicarbonate	Smooth and fairly easily disintegrated.
7	Potassium Bicarbonate	Fairly smooth but not so easily disintegrated.

NOTES:

For general notes see Table No. 1.

other alkalies. This is due to the action of the dissolved carbonic acid, liberated from the bicarbonate by the acid phosphates of the milk, on the secondary calcium phosphate probably forming a very unstable double salt of calcium (soluble) ($Ca.H_2PO_4.HCO_3$) analogous to the formation of calcium bicarbonate. This means an increase of available calcium. Experiment No. 4 will demonstrate this action.

Both Brennemann[7] and Southworth[17] have noted the excessive liberation of gas in the form of eructions from milk modified with bicarbonates; this is due partly to the dissolved carbon dioxide and partly to the dissolved carbon dioxide and partly to the unstable compound above referred to, breaking down by heat and liberating carbonic acid.

The effect on the potential acidity of milk by sodium bicarbonate is as follows:

100 mils milk—18.5° acidity and 0.100 $NaHCO_3$	13.1° acidity
100 mils milk—18.5° acidity and 0.100 $NaHCO_3$— after reaching 38° C.	13.1° acidity
100 mils milk—18.5° acidity and 0.100 $NaHCO_3$ 20 minutes at 38° C.	11.4° acidity

Phenolphthalein indicator.

This decrease of acidity by heat is due to the decomposition of the sodium bicarbonate with the formation of normal sodium carbonate. For this reason, if milk is to be pasteurized or sterilized and modified with sodium bicarbonate, the bicarbonate must be added after cooling, otherwise the mixture will be strongly alkaline.[18]

Potassium Bicarbonate.—Whatever applies to sodium bicarbonate applies equally to the potassium salt. From Table No. 3 it will be seen that the quantitative effects are practically identical. Potassium bicarbonate seems to be more stable in solution than the sodium salt, although both change alkalinity on standing or heating. In precipitating calcium salts (reducing the acidity of milk) bicarbonates act according to the following equation:

$$2NaHCO_3 + Ca(H_2PO_4)_2 = \underline{CaHPO_4} + Na_2HPO_4 + 2H_2CO_3$$

There are so many disadvantages in the use of bicarbonates that their employment should be discouraged and abandoned.

Sodium and Potassium Carbonates.—No data can be found where these salts have been used except in proprietary malt foods. On purely theoretical grounds, their use would be better than the corresponding bicarbonates because they will not increase in alkalinity on standing. If their use is thought desirable, it is recommended that nothing but sodium carbonate monohydrated be used, as this is the only salt the physician may expect to be dispensed in a uniform manner.

Hydroxides.—The commonly used hydroxides are lime water and milk of magnesia. Sodium and potassium hydroxides could just as well be used and even ammonia water. The main difficulty regarding the use of the three latter substances is due to the lack of uniformity in dispensing such unstable products. This practical point has been demonstrated by analyses of solutions purchased for this purpose. From the analyses, it is certain that if a physician desires to use either sodium or potassium hydroxide he must be assured the product dispensed is *assayed and adjusted to a definite standard*, preferably a one percent solution. Because of the apparent usefulness of these products, definite figures will be presented for those who desire to use them.

The use of alkalies has been on a very irrational basis. Most physicians

add certain quantities of alkalies on a percentage basis of the total milk mixture regardless as to whether it is whole milk or diluted milk.[18,19] In some cases this method has resulted in the use of equal volumes of lime water and milk. While it is true that the modification of milk with alkalies, as has been practiced in the past, has been in most cases successful, their use on a definite basis would bring even happier results and would certainly clarify clinical data in this respect.

The use of alkalies has been based on the difference in acidity of cows' milk and human milk, cows' milk being about six times as acid as human milk. Human milk has three degrees acidity while cows' milk has on an average eighteen degrees acidity. A degree of acidity is equivalent to 1 mil of normal acid per litre. By the use of the following equations, a physician will be able to feed a milk mixture of any desired degree of acidity.

Sodium Hydroxide.—Sodium hydroxide neutralizes milk and precipitates calcium salts according to the equation

$$Ca(H_2PO_4)_2 + 2NaOH = \underline{CaHPO_4} + Na_2HPO_4 + 2H_2O.$$

1.92 minims of a 1% sodium hydroxide *w/v* solution will reduce the acidity of 1 fluidounce of milk 1 degree. If it is desired to reduce 16 fluidounces of milk to 3 degrees, multiply the number of minims that will reduce 1 fluidounce 1 degree by the number of degrees to be reduced and by the number of ounces of milk; thus—(15 degrees acidity to be reduced)

$$1.92 \times 15 \times 16 = 461 \text{ minims } 1\% \text{ NaOH solution required.}$$

In reducing the acidity of diluted milk mixtures, the above equation is not applicable because water added to milk will reduce the acidity of the mixture by simple dilution. Because this acidity reduction by dilution deviates from the mathematically calculated acidity, a correction factor must be introduced. These factors are derived from graph curves in an article by the writer in the JOURNAL OF THE AMERICAN PHARMACEUTICAL ASSOCIATION, July 1919, and those required will be enumerated in this article as needed.

The equation for diluted milk mixtures is:

$$\left(\frac{m \times 18}{m + w}\right) \times \text{factor} - 3 = d$$

$d(m + w)$ 1.92 = minims 1% NaOH solution to add.

m = number of fluidounces of whole milk, top milk or cream in formula.

18 = degrees of acidity of whole milk, top milk or cream in formula.

w = number of ounces of water or gruels in formula.

Factors for Sodium Hydroxide.—

If the milk occupies about 75% of the volume of the mixture, the factor is.....0.96
If the milk occupies about 60% of the volume of the mixture, the factor is.....0.93
If the milk occupies about 50% of the volume of the mixture, the factor is.....0.91
If the milk occupies about 33% of the volume of the mixture, the factor is.....0.86
If the milk occupies about 25% of the volume of the mixture, the factor is.....0.84

In all but clinical experimentation these factors can be disregarded.

3 = number of degrees of acidity of finished milk mixture desired; if six degrees acidity are desired, 6 is substituted for the 3, etc.

d = number of degrees of acidity to be reduced.

Example.—It is desired to reduce a mixture of 1/2 pint of milk and 1/2 pint of water to 5 degrees acidity.

$$\left(\frac{m \times 18}{m + w}\right) \times \text{factor}—5 = d.$$

$$\left(\frac{8 \times 18}{8 + 8}\right) \times 0.91 — 5 = 3.19 \text{ degrees (practically 3.2).}$$

$d(m + w)1.92$ = minims of 1% NaOH solution to be added.
$3.2 \times 16 \times 1.92$—98 minims of 1% NaOH solution to be added.

The acidity of milk of individual cows may vary somewhat from eighteen degrees, but the writer has titrated hundreds of samples of market herd milk and has not found any samples outside the limits of seventeen to nineteen degrees. The literature reports milks varying in acidity over a wide range but from the writer's experience he is led to believe this is due to a lack of uniformity in the methods used by the different chemists. Factors that do not affect an ordinary titration vitally affect a milk acidity titration. This matter was taken up in technical detail by the writer in a former article.[4]

Potassium Hydroxide.—All that applies to sodium hydroxide applies equally to potassium hydroxide. 2.69 minims of a 1% potassium hydroxide *w/v* solution will reduce the acidity of 1 fluidounce of milk 1 degree. Factors for potassium hydroxide are practically identical to those for the sodium hydroxide. All the other values of the equations are the same.

Ammonia Water.—No figures are given as it is thought desirable to use other hydroxides. Attention is called to the slightly less retarding effect of ammonia water as compared to sodium and potassium hydroxides (Table No. 3); this is due to the acid hydrolysis of the ammonium salts. See Table No. 2 and compare ammonium chloride to potassium and sodium chloride.

Lime Water.—This time-honored pharmaceutical equals, if not exceeds in popularity, milk of magnesia for milk curd modification. It seems paradoxical that if we desire to reduce the calcium-ions in milk this is actually accomplished by the addition of further calcium-ions in the form of lime water. However, it is not the calcium of lime water but the *hydroxyl* that functions here. This action is as follows:

$$Ca(H_2PO_4)_2 + Ca(OH)_2 = \underline{2CaHPO_4} + 2H_2O$$

or

$$Ca(H_2PO_4)_2 + 2Ca(OH)_2 = \underline{Ca_3(PO_4)_2} + 4H_2O$$

This shows that lime water acts as all other alkalies by precipitating calcium, which reduces the concentration of one of the active masses required for coagulation.

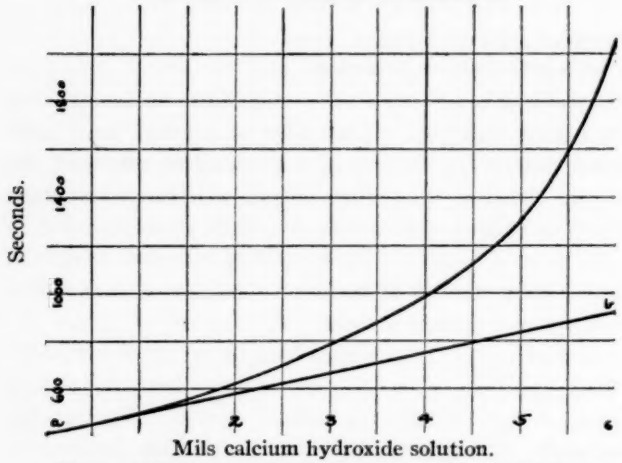
Since lime water contains only about $^1/_6$ of 1% calcium hydroxide, its proper use necessitates a rather large volume, and this is the chief objection to lime water. It is reduced in strength by the carbon dioxide in the air, but has little action on glass vessels. In this particular, it is far superior to sodium or potassium hydroxide solutions. Lime water is more uniform in composition and its action is more definite than any alkali used at the present time, milk of magnesia included. For the quantitative effect of lime water see Chart No. 3; this shows that about one-half ounce is equivalent to one and one-half grains of either sodium or potassium citrate.

A solution of calcium hydroxide was used assaying 1.357% $Ca(OH)_2$ *w/v*;* this was used to study the action of calcium hydroxide in a more concentrated

*Calcon.

form. For the effect on milk coagulation of progressively increasing amounts of this solution see Graph No. 2.

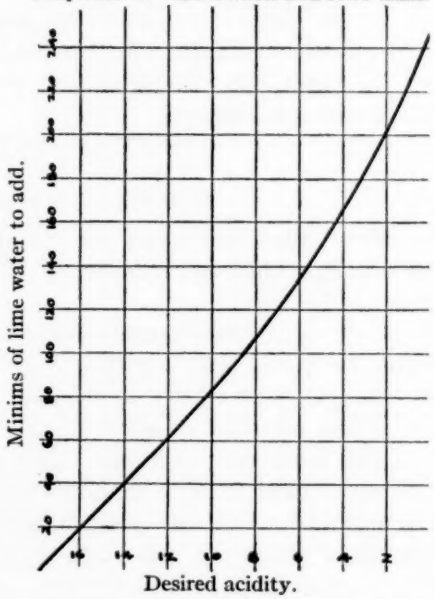
Graph No. 2.—Rate of coagulation.



Notes.—Milk: mixed herd. Specific gravity at 15 C 1.034. Fats, 3.9%. Acidity, 16.7 degrees
Rennin: 0.5% solution of 1–30000. Calcium hydroxide solution: Calcium hydroxide (sucrose) solution assaying 1.357% $Ca(OH)_2$; this minimizes aqueous dilution. *a–b:* Mathematical retardation.

Dr. T. Wood Clarke, of Rockefeller Institute, has contributed a very comprehensive paper on the effect of certain modifying agents on the gastric digestion of infants.[20] Dr. Clarke experimented on babies by feeding various mixtures and pumping the stomach after set intervals and analyzing the contents. His conclusions in regard to lime water are as follows: "Lime water itself appears not to act as is generally accepted in practical pediatrics, by reducing the acidity of the child's stomach. While unquestionably neutralizing a portion of the hydrochloric acid, the alkali stimulates a further secretion of gastric juice." This is certainly true of lime water *itself* (unaccompanied by milk) but it certainly is not true in regard to milk containing lime water. From five to ten percent of milk mixtures usually consist of lime water and there can be no free calcium hydroxide present in such mixtures to act on the gastric juice as such mixtures are still quite acid. Fifty-one percent of lime water (0.163% $Ca(OH)_2$) is required to neutralize, not alkalinize, fresh cows' milk. The stomach strives to maintain a certain normal degree of acidity during digestion and if we feed a food less acid than the contents of the stomach this momentarily reduces the acidity by simple dilution and then the stomach secretes more acid to maintain its normal acidity. Hawk[21] has shown in this manner that even water will stimulate the flow of gastric juice proportional to the amount of water ingested.

Graph No. 3.—Lime water and cows' milk.



Lime water does not delay the coagulation of milk quite as much as does milk of magnesia, but the character of the curds formed in each case seems to be identical. Brennemann[7] concludes in respect to lime water: "Subjectively

they (the curds) are described as 'the softest yet' and the returned stomach contents were said to have a very sweet taste that was present in no other experiment. The curd of milk to which lime water has been added would thus seem, on account of its thin ribbon-like, porous character, to be a peculiarly favorable one for the action of the digestive juices." In this connection Helmick states that he believes the reason some physicians fail to obtain satisfactory results with lime water is that they do not use it in sufficient quantities.

Because of its bulkiness compared with its alkalinity, lime water reduces the acidity of the milk by both simple dilution and chemical action. Due to this double action one cannot calculate the amount of lime water required except by the use of experimental data plotted in the form of graph curves. Graph No. 3 gives the number of minims of lime water necessary to *add to* 1 fluidounce of undiluted whole milk to reduce the acidity of the *resultant mixture* to the desired degree of acidity.

Example.—16 ounces whole milk are desired to be reduced to 12° acidity. The chart shows that it requires 62.4 minims for 1 ounce; therefore, 62.4 × 16 = 998 minims of lime water to be added. This gives a total volume of 18 ounces of 12° acidity.

When lime water is used in diluted milk formulas, the equations given under sodium hydroxide for diluted milk are used by substituting the lime water values for the sodium hydroxide values. 15.0 minims of lime water (based on 0.163% $Ca(OH)_2$) will reduce the acidity of 1 fluidounce of cows' milk 1 degree.

Factors for Lime Water.—
If the milk occupies about 75% of the volume of the mixture, the factor is....0.96
If the milk occupies about 60% of the volume of the mixture, the factor is....0.94
If the milk occupies about 50% of the volume of the mixture, the factor is....0.92
If the milk occupies about 33% of the volume of the mixture, the factor is....0.77
If the milk occupies about 25% of the volume of the mixture, the factor is....0.71

Milk of Magnesia.—For its quantitative action see Chart No. 3. The alkalinity of milk of magnesia is due to magnesium hydroxide in suspension. The fact that the active substance is in suspension and not in solution is the chief objection to this product. This explains its somewhat sluggish action. It is axiomatic that the more surface of the magnesium hydroxide exposed to the milk, the more quickly they will react with each other.[22] This is the reason that the more colloidal the magma is the more desirable it is for this purpose.

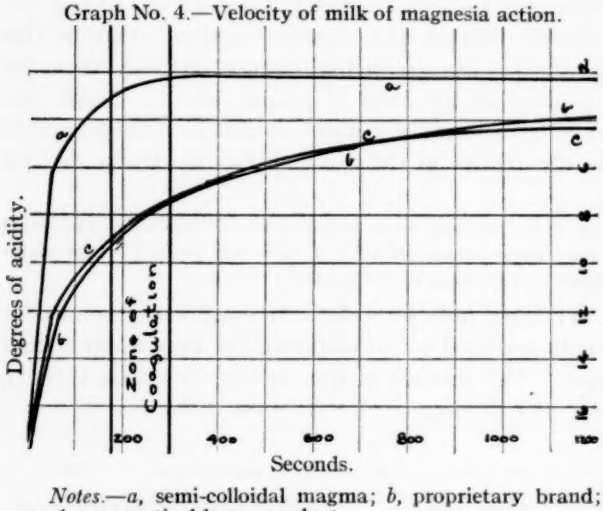
Although there is a standard for this product in the Pharmacopoeia, manufacturers seem to pay little attention to it. The Pharmacopoeia permits a variation of 6.5% to 7.5% $Mg(OH)_2$. Actual analyses of the most widely sold brands, and products from the most reliable pharmaceutical houses, vary from 5.22% to 9.79%.[23] It is evident, then, that a physician can never be certain of uniformity of milk of magnesia, not even by using only one brand, although the variation in strength in this case may not be as great as the above figures.

The ideal milk of magnesia for milk curd modification is a product containing a definite amount, between 1.5 to 2%, of magnesium hydroxide and so precipitated that the particles are almost colloidal in size. Such a product is a thick, translucent, viscous fluid which shows little water separation on long standing. The time will come when such a product as this will be demanded by the physicians and the public in preference to our present-day magmas.

Graph No. 4 shows the activity of such a product compared to a well-known proprietary brand and a standard pharmaceutical house product. It will be

noted that this semi-colloidal product practically assumes maximum activity in about 300 seconds as compared with about 900 seconds for the other brands. As milk coagulates in the stomach in from three to five minutes, milk of magnesia should be made so as to exhibit as much alkalinity as possible in this interval. In these graph tests, all the magmas were mixed with the milk in the proportion to obtain three degrees acidity; this condition will probably not be reached in the case of the two market brands for about five hours, whereas the semi-colloidal magma has reached it in about 300 seconds. Where a day's feedings are mixed at one time this sluggish action is negligible except on the first feeding, because after that, sufficient time has elapsed for the reaction to take place. Quite a large number of mothers feed the infants on extemporaneously made mixtures, and in this case this condition becomes important. In this connection the writer does not want to be understood as condemning the present-day magmas as being inefficient—quite the contrary—they are efficient—but the point desired to be made is, that a magma made in a more colloidal condition would be more efficient and give better satisfaction generally.

Graph No. 4.—Velocity of milk of magnesia action.



Notes.—*a*, semi-colloidal magma; *b*, proprietary brand; *c*, pharmaceutical house product.
Zone of coagulation: Approximate interval of time for milk to coagulate in stomach under normal conditions.

It would seem from the wide variation in strength and its sluggish action that milk of magnesia could be much better substituted by one of the soluble alkalies such as potassium or sodium hydroxide or lime water. The only case where this would not be feasible is where the physician wants a laxative as well as an alkaline effect.

Milk of magnesia neutralizes milk as follows:

$$Ca(H_2PO_4)_2 + Mg(OH)_2 = \underline{CaHPO_4} + MgHPO_4 + 2H_2O$$

–or–

$$3Ca(H_2PO_4)_2 + 6Mg(OH)_2 = \underline{Ca_3(PO_4)_2} + 2Mg_3(PO_4)_2 + 12H_2O$$

The apparent weakness of lime water and milk of magnesia as compared with sodium and potassium hydroxides (Table No. 3) is due to the fact that a larger quantity of $\frac{N}{10}$ $Ca(OH)_2$ is required than of $\frac{N}{10}$ NaOH to neutralize milk. For the explanation of this phenomenon see reference No. 4.

For the quantitative effect in reducing milk acidity the equations under sodium hydroxide, both for whole and diluted milk, are correct for milk of magnesia after substituting the milk of magnesia values for the sodium hydroxide values.

0.236 grain milk of magnesia 7%* will reduce the acidity of 1 fluidounce of cows' milk 1 degree.

* By calculation the figures for any strength magma may be obtained.

Factors for Milk of Magnesia.—

If the milk occupies about 75% of the volume of the mixture, the factor is.....0.90
If the milk occupies about 60% of the volume of the mixture, the factor is.....0.84
If the milk occupies about 50% of the volume of the mixture, the factor is.....0.80
If the milk occupies about 33% of the volume of the mixture, the factor is.....0.77
If the milk occupies about 25% of the volume of the mixture, the factor is.....0.69

In clinical observations milk of magnesia must be weighed, as the error in measuring is quite considerable. This is impracticable for the mother at home; here, a weaker product such as the semi-colloidal magma would lessen the error from inequalities of measurement.

In connection with milk of magnesia, I cannot help but make a therapeutic trespass and call attention to the so-called calcium-magnesium balance in the body. It seems that the quantity of calcium and magnesium in the system is a constant and if we increase the consumption of one, we automatically diminish the other. In this connection, Benedict says that "magnesium forces calcium from the system and hinders the calcium retention necessary for bone building. This might be a highly undesirable effect from the repeated administration of milk of magnesia to infants."[24]

SUMMARY.

1. The object in modifying cows' milk is due to the great difference in the physical condition of the curds from it and human milk.
2. The caseins from the two milks probably are identical.
3. Milk is coagulated by the combined action of rennin and calcium-ions, each acting independent of the other.
4. Freshly formed curds have a powerful cohesive property, which property is rapidly discharged.
5. Diluting the milk with water modifies the curd by decreasing the concentration of the active masses.
6. Gruels or cereal decoctions act as protective colloids by virtue of the gelatinized starch present.
7. Sugars, except lactose, have little action on the character of the curd. Lactose seems to favorably modify it.
8. Boiling the milk profoundly alters the character of the curd by the removal of calcium salts by scum formation.
9. Citrates modify milk curd formation by fixation of calcium-ions.
10. All alkalies act by precipitating calcium salts; thereby reducing the concentration of one of the active masses.
11. Sodium or potassium hydroxides are desirable modifying agents but their purchase must be attended with care.
12. Lime water acts like all other alkalies by precipitating calcium. The curd from lime water has very desirable properties.
13. Milk of magnesia has practically the same effect on curd formation as lime water, but its action is slower.

No single method of modification produces the *ideal* curd. This can only be accomplished by a combination of dilution to the proper caseinogen concentration, the addition of a citrate to establish the correct calcium-citrate ratio, the adjustment of the mineral constituents, the addition of an alkali to reduce the acidity and properly stimulate gastric secretion, and by the addition of a protective colloid to establish the correct casein-lactalbumin ratio.

Before these combinations can be studied certain mechanical defects in artificial stomachs must be overcome and then the data obtained can be applied

to clinical experimentation and then simplified for practical application. Until these matters are solved the modification of milk coagulation will remain as it is on an unscientific and unsatisfactory basis.

In conclusion the writer desires to express his appreciation to Dr. Arthur G. Helmick, of Columbus, Ohio, for many helpful suggestions and information regarding clinical experiences.

FEBRUARY 25, 1921,
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THE RELATIVE ACTIVITY OF DIFFERENT PARTS OF THE DIGITALIS PLANT.*

BY GEO. E. ÉWE.

The U. S. P. Ninth requires that official digitalis consist of "the carefully dried leaves of Digitalis Purpurea Linné (Fam. Scropulariaceae), without the presence or admixture of more than 2 percent of stems, flowers or other foreign matter. If made into the official tincture and assayed biologically, the minimum lethal dose should not be greater than 0.006 mil of tincture, or the equivalent in tincture of 0.0000005 Gm. of Oubain, for each gramme of body weight of frog."

Determinations of activity have proven that the separate parts of the plant individually answer the U. S. P. requirements for minimum lethal dose.

In order to ascertain the relative proportions of the different parts of the

* I am indebted to Dr. P. S. Pittenger and Arnold Quici for the careful tests of physiologic activity of the various tinctures mentioned in this paper.

digitalis plant and thus determine the increase in yield of drug which was to be expected from gathering the whole plant instead of only leaves, as required by the U. S. P., one hundred freshly harvested, complete, non-flowering digitalis plants grown at Glenolden, Pa., were properly divided into leaves without petioles, petioles and roots and crowns, respectively, the work being performed within twenty-four hours after harvesting.

The results are tabulated herewith:

WEIGHTS OF SEPARATE PARTS OF 100 FRESHLY HARVESTED DIGITALIS PLANTS.

Part of plant.	Weights.	Percentage.
Whole Plant	110 1/2 lbs.	100.0%
Leaves without Petioles	60 lbs.	54.3%
Petioles	38 lbs.	34.1%
Roots and Crowns	7 1/4 lbs.	6.4%
Loss in Handling and as Moisture	5 1/4 lbs.	5.4%

Since the above figures were based on the fresh, and therefore naturally moist drug, whereas digitalis is purchased on a basis of drug air-dried to a grindable state, the parts of the plants were permitted to air-dry to a grindable state, and were then reweighed. The losses in moisture were 74.8 percent for the leaves without petioles, 83.4 percent for the petioles and 64.7 percent for the roots and crowns.

WEIGHTS OF SEPARATE PARTS OF 100 WHOLE DIGITALIS PLANTS AIR-DRIED TO A GRINDABLE STATE.

Part of plant.	Weights.	Percentage.
Leaves without Petioles	15 lbs. 1 1/2 oz.	63.0%
Petioles	6 lbs. 5 oz.	26.3%
Roots and Crowns	2 lbs. 9 oz.	10.7%

Therefore the increase in yield due to collection of the roots and crowns would amount to between 5 and 10 percent, depending upon the moisture content.

On a moisture-free basis the increase in yield due to collection of roots and crowns would be even greater since they contain proportionately less moisture than the other parts of the plant. This is shown by the following table, giving total moisture content of recently harvested drug and drug air-dried to a grindable state (and ground), the determinations being made by drying at 100° C. to constant weight.

Part of plant.	Recently harvested.	Air-dried to grindable state (and ground).
Whole Plant	79.6%	6.1%
Leaves without Petioles	77.7%	6.6%
Petioles	90.1%	7.9%
Roots and Crowns	65.3%	4.3%

PHYSIOLOGIC ACTIVITY OF DIFFERENT PARTS OF DIGITALIS PLANT.

The whole plant and the different parts of the plant, air-dried to a grindable state (and ground), were made into tinctures by the U. S. P. process for Tincture Digitalis, and were then assayed physiologically. The results are herewith tabulated:

Part of plant.	Whole plant.	Leaves w/o petioles.	Petioles.	Roots and crowns.
Physiologic Activity (Compared with U. S. P. Standard)	Sample 1—166% Sample 2—166%	Sample 1—250% Sample 2—250%	Sample 1—111% Sample 2—125%	Sample 1—177.6% Sample 2—177%

The results of physiologic assay indicate that the whole plant and each of the different parts of the plant, individually, conform to the U. S. P. standard of activity.

DIGITOXIN CONTENT OF DIFFERENT PARTS OF THE DIGITALIS PLANT.

The tinctures made from the whole plant and different parts of the plant, air-dried to a grindable state (and ground), which were used for the determination of physiologic activity, were assayed for digitoxin with the following results:

Part of plant.	Whole plant.	Leaves w/o petioles.	Petioles.	Roots and crowns.
Digitoxin per 100 cc.	Sample 1— 0.0145 Gm.	Sample 1— 0.0285 Gm.	Sample 1— 0.0105 Gm.	Sample 1— 0.0068 Gm.
	Sample 2— 0.0160 Gm.	Sample 2— 0.0300 Gm.	Sample 2— 0.0125 Gm.	Sample 2— 0.0064 Gm.

The arbitrary standard for digitoxin in Tincture of Digitalis is 0.025 Gm. so that only the tincture made from the leaves without petioles is in accordance with this arbitrary standard. This standard is based upon tincture made from the leaf. In view of the high physiologic activity of the petioles and the roots and crowns it is evident that the activity of these portions of the plant is due largely to glucosides other than digitoxin.

TOTAL ASH, ACID INSOLUBLE ASH, EXTRACTIVE CONTENT AND COLOR OF TINCTURES MADE FROM THE DIFFERENT PARTS OF THE DIGITALIS PLANT.

The total and acid insoluble ash of the whole and different parts of the plant and the extractive content and colors of the tincture made from the whole and different parts of the plant are herewith recorded as a matter of interest and as a contribution to this subject:

Part of plant.	Whole plant.	Leaves w/o petioles.	Petioles.	Roots and crowns.
Total Ash Content	32.7%	20.8%	27.7%	14.7- 14.8% 14.9
Acid Insoluble Ash Content	25.7%	13.6%	19.5%	6.5- 6.6% 6.7
Extractive Content of Tincture	1.825-1.876% 1.928	2.488-2.381% 2.275	2.29-2.295% 2.30	1.42- 1.435% 1.45
Color of Tincture	Light greenish brown	Dark greenish brown	Pale brownish green	Pale brown

The total ash and acid insoluble ash determinations were made on samples which were merely vigorously shaken in an effort to deprive them of sandy particles. The roots and crowns were washed and air-dried before the determinations were made. All of the determinations were made on samples air-dried to a grindable state (and ground).

Total and acid insoluble ash determinations made on roots alone, which were washed and then dried at 100° C., showed 13.7 and 13.4%, average 13.55%, of total ash and 8.2 and 8.1%, average 8.15%, acid insoluble ash.

SUMMARY.

Evidence is offered regarding the relative activities of the different parts of the digitalis plant in comparison with the whole plant.

Determinations of physiologic activity, digitoxin content, extractive content and color of tinctures prepared from different parts of the digitalis plant, in com-

parison with the whole plant, are recorded.

The roots and crowns, which are not now official, yield tinctures conforming to the U. S. P. standard of activity when free from excessive soil.

The roots and crowns amount to between 5 and 10% of the crop.

Data are recorded on the relative weights of the separate parts of freshly harvested plants and plants air-dried to a grindable state; the moisture contents of recently harvested plants and their parts and plants and their parts air-dried to a grindable state and total and acid insoluble ash content of the whole plant and its parts.

PHARMACEUTICAL RESEARCH DEPARTMENT,
H. K. MULFORD COMPANY,
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THE ASSAY OF MERCURIC SALICYLATE.

BY E. F. KELLY AND J. C. KRANTZ, JR.

The U. S. P. process for the assay of mercuric salicylate is faulty in that it oes not accomplish what it sets out to do, *viz.*, to produce mercurous chloride and estimate this iodometrically.

The Pharmacopoeia directs that a weighed quantity (about 0.5 Gm.) of mercuric salicylate be heated on a water-bath with a mixture of nitric and sulphuric acids, until dissolved. The solution is never complete, no matter how long the mixture is heated, since the mercuric nitrate produced is not soluble in the acids. What does happen is, the mercuric nitrate remains on the bottom of the container, after the oxides of nitrogen fumes cease to be evolved, and is dissolved immediately on the addition of water. A higher temperature than 100° C. will considerably shorten the process.

Having then a solution of mercuric nitrate, measuring about 150 mils, 30 mils of solution of hydrogen dioxide are added to insure a complete oxidation. To this, the Pharmacopoeia directs that 5 mils of diluted hypophosphorous acid be added, and then 5 Gm. of sodium chloride, dissolved in 20 mils of water. Here the real error occurs in the official process; for when the diluted hypophosphorous acid is added the solution immediately becomes dark, due to the separation of finely divided metallic mercury.

If the sodium chloride solution is quickly added some mercurous chloride may also be precipitated, but the quantity is small. It is true that the metallic mercury, after being collected on a filter and washed, can be estimated iodometrically, but it is taken up so slowly that several hours are required, even if a mechanical shaker be used.

If, however, the order of the addition of the diluted hypophosphorous acid and the sodium chloride solution is reversed, that is, if the sodium chloride is added first and then the reducing agent, a dense white precipitate results, free from metallic mercury. This, when collected and washed, can be estimated immediately with tenth-normal iodine volumetric solution.

The late Dr. Frontis Lentz had occasion to assay some twenty-five samples of mercuric salicylate, produced by several manufacturers, during the period of the war, and found these modifications of the official process to be satisfactory

in every instance, whereas he failed on perhaps ten occasions to obtain concordant results when using the process as it appears in the ninth revision of the Pharmacopoeia.

It was therefore suggested by Dr. Lentz that the U. S. P. process be modified, to read as follows:

Heat about 0.5 Gm., accurately weighed, in a mixture of 15 mils of sulphuric acid and 10 mils of nitric acid, over a small flame until the oxides of nitrogen fumes cease to be evolved and the liquid is of a pale yellow color. Cool the mixture, dilute it with 150 mils of distilled water, add 30 mils of solution of hydrogen dioxide and mix well. Now add 5 Gm. of sodium chloride, dissolved in 20 mils of distilled water, then add gradually, with constant stirring, 5 mils of diluted hypophosphorous acid. Stir thoroughly, then allow the mixture to stand until the precipitate has subsided. Filter and wash the precipitate with distilled water. Transfer the precipitate and filter to a flask, add 50 mils of tenth-normal iodine volumetric solution and 2 Gm. of potassium iodide, agitate the mixture until all the precipitate has dissolved, then titrate the excess of tenth-normal iodine volumetric solution with tenth-normal sodium thiosulphate volumetric solution.

DRUG TOPICS.*

No. 3. Evaluation of Wintergreen Leaves.[1]

BY R. W. ADAMS.

The leaves of *Gaultheria procumbens* have possibly never been regarded as an important drug. To-day the average drug clerk of our cities may not know it. If found at all in a drug store it is most likely contained in compressed packages the inside of which is rarely, if ever, seen by the salesman behind the counter.

Wintergreen oil has been replaced for the most part by sweet birch oil and artificial methyl salicylate. But, although the production of true wintergreen oil from the leaves of *Gaultheria procumbens* is still an agricultural or, more correctly, a forest industry of some local importance in certain states, this fact adds nothing to the significance of the drug as such.

Nevertheless wintergreen is still an article of commerce and the person who has occasion to purchase a bale ought to know whether the price asked for the drug is at all indicative of its quality. Drug brokers may judge the leaves by their appearance, yet the best appearing leaves may be valueless so far as available volatile oil is concerned. The writer has even met persons who thought that a nice-looking green leaf was of first quality because the drug had the peculiar wintergreen odor. In most cases, there is reason to suspect that neither collector, broker, nor purchaser cares a rap about the quality of the leaf so long as the price admits of a satisfactory business transaction. The writer knows of at least one bale of about 150 pounds of North Carolina leaf that was sold by a "reliable" firm for a fair price, when the leaves were almost useless for the purpose for which they had been purchased. No doubt the leaves had passed through various hands, yet no one seems to have given any thought whatever to the quality of the leaves. Even though wintergreen leaves are not used where a question of life and death is involved, the mere matter of business honesty seems to demand more consideration than has

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* From the Laboratory of Edward Kremers.

[1] Extracts from R. W. Adams, "Oil of Wintergreen from Gaultheria." Thesis University of Wisconsin, 1910.

been given to this drug. If nothing more were accomplished than to drive the ignorant drug collector and vendor out of business something worth while would be accomplished that must react favorably on the entire drug trade.

The commercial value of gaultheria leaves depends on their gaultherin content. The amount of glucoside can readily be ascertained by the colorimetric determination of the methyl salicylate, produced upon hydrolysis, with ferric chloride. As a standard a one-tenth percent solution of artificial ester may be used for comparison.

The conditions most favorable to an assay were ascertained by Ziegelmann[1] who found that for small quantities, such as are used in an assay, 24 hours of maceration at room temperature are the most favorable. These experiments were repeated by Adams who substantiated them. He reports the following results for 6 Gm. lots per assay:

Time of maceration.	Yield.
12 hours	0.63 p. c.
12 hours	0.64 p. c.
24 hours	1.00 p. c.
24 hours	0.97 p. c.
48 hours	1.00 p. c.

Inasmuch as the highest yield of wintergreen oil from gaultheria leaves recorded is only 0.80 p. c., the assay results seem rather high. Indeed, Ziegelmann did not succeed in obtaining, upon distillation on a semi-economic scale, much more than one-half of the oil indicated by assay. His results with sweet birch, likewise, fell materially below the yield indicated by assay. However, he does not appear to have cohobated the aqueous distillates, a fact that may readily account for the low yield of oil. For this purpose the oil distillation experiments were repeated with results tabulated below. The leaves, covered with water, were allowed to macerate 24 hours previous to distillation.

No. of expt.	Wt. of herb.	Wt. of oil.	P. c. oil.	$d_{15}°$.
1.....	48 lbs.	265 Gm.	1.22 p. c.	1.1780
2.....	77 lbs.	492 Gm.	1.40 p. c.	1.1780
3.....	113 lbs.	569 Gm.	1.11 p. c.	1.1730
4.....	140 lbs.	200 Gm.	0.31 p. c.	1.1724

Materials Nos. 1, 2 and 3 had been collected by Indians near Black River Falls, Wis., under the supervision of the Missionary. No. 1 had been collected in the fall of 1909 and thoroughly dried; No. 2 in the spring of 1910 and thoroughly dried; No. 3 also in the spring of 1910, but not thoroughly dried. The yields are high and if the cohobation had been carried farther might, no doubt, have been increased at least slightly. It might be concluded that the leaves collected in spring yield more oil than those collected in fall, but to draw such a conclusion from single experiments would be rash indeed. More striking is the lower yield obtained from leaves collected during the same season but not thoroughly dried (contrast No. 3 with No. 2). The very fact that the leaves had a wintergreen odor, though their appearance was perfect, revealed in itself insufficient drying (due to rainy weather), as is further substantiated by the lower yield of oil.

But, if the Indians failed in one instance to turn out a perfect drug, what

[1] E. F. Ziegelmann, "Oils of Wintergreen and Birch," *Pharm. Rev.*, 23, p. 83.

will one say of the bale of 140 lbs. (No. 4) obtained from a southern state? Here the yield proved to be less than 25 percent of the best yielding drug collected and cured by the Indians (compare No. 4 with No. 2).

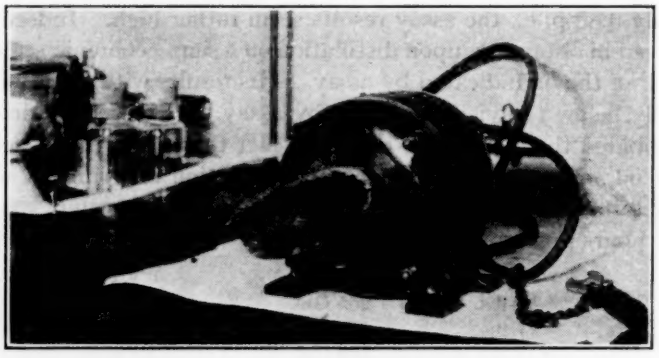
It is further noteworthy that the leaves which had not been properly cured yielded oils with a slightly lower density than that of the oils from perfect leaves.

To claim that the assay of gaultheria leaves yields perfect results would be foolish. As yet we have had too little experience therewith. However, this much may be claimed for it, *viz.*, that it would have prevented such a fraud as the sale of the 140-lb. bale of grossly inferior leaves. More than that, its application to the wintergreen oil industry may yet place the distillation of true wintergreen oil and sweet birch oil on a scientific basis.

THE ASH YIELD OF CALUMBA.

BY E. L. NEWCOMB, C. H. ROGERS AND C. V. NETZ.

Calumba is a drug which is ordinarily considered to be quite clean. A careful study of a series of samples indicates that there may be nearly five percent of dirt present. The majority of commercial samples appear to contain less than one percent of sand, clay or other foreign inorganic matter measured as acid-insoluble ash.



Motor with brush attached—used for preparing *clean* drugs for normal ash determinations.

Carefully cleaned samples of commercial Calumba usually yield between four and five and one-half percent of total ash. The amount of the ash insoluble in 5% hydrochloric acid runs less than one-half percent with the well-cleaned samples.

A method was previously described for removing on a commercial scale the sand and clay from crude vegetable drugs. In working with small quantities of drugs, such as roots, it is not practicable to use a mechanically operated gyrator sifter. For making fairly accurate determinations of the total and acid-insoluble ash of vegetable drugs freed from all foreign matter, one should preferably begin the work with the living material. With many of our drugs from the tropics, this is, however, quite out of the question. The following method is applicable to quite a number of drugs; we have used it successfully and present it for what value it may be to others.

Motor Brush for Cleaning Drugs.

A small brush, such as the ordinary hand scrub brush, is fastened to the end of the shaft of an electric motor. This may easily be done by making a tapering hole in the center of the back of the brush. The brush may then be wedged on to the shaft. The motor which we have used is a General Electric Co. machine—1/4 H. P., 1730 R. P. M., alternating current. This machine may be connected to almost any electric light line with alternating current. The switch is turned on and the selected pieces of the drug held firmly but gently against the rapidly revolving brush. A little practice is necessary in order to simply remove the fine particles of foreign matter and not to burnish the sample. With a drug like Calumba, for example, it is important not to remove any of the corky layer, on account of the stone cells containing calcium oxalate which occur in this tissue. With proper care, the method will yield as near perfectly clean samples as we may expect.

The following results relate to the standard for Calumba:

TOTAL AND ACID-INSOLUBLE ASH OF CALUMBA. BY C. H. ROGERS AND C. V. NETZ.

Sample No.	Source of sample and remarks.	Percent total ash.	Percent insoluble in 5% HCl.
1.	Commercial powder, bought 1920	6.66	0.89
		6.48	1.06
2.	Commercial powder, bought 1910	9.43	4.26
		9.27	4.54
3.	Commercial powder, bought 1920 (labeled "3.32% ash")	8.04	3.49
		8.02	3.29
4.	Commercial sample, bought 1908, powder	6.64	1.46
		6.77	1.62
5.	Commercial whole drug, powdered in this laboratory 12/4/20 without cleaning	5.64	0.72
		5.61	0.78
6.	Commercial whole drug, bought 1920, powdered in this laboratory 12/4/20 without cleaning, No. 30	6.43	1.35
		6.53	1.38
7.	Commercial whole drug, bought 1920, powdered in this laboratory 12/4/20 without cleaning, No. 30	4.76	0.35
		4.72	0.38
8.	Commercial whole drug, bought 1920, powdered in this laboratory 12/4/20 without cleaning, No. 30	6.31	0.67
		6.39	0.57
9.	Commercial whole drug, bought 1920, powdered in this laboratory 12/4/20 without cleaning, No. 30	5.74	0.82
		5.86	0.78
10.	Commercial sample, whole drug, bought 1920, powdered in this laboratory 12/4/20 without cleaning	5.12	0.60
		5.13	0.51
11.	Commercial whole drug, same as No. 5, above, except cleaned by motor brushing and powdered, No. 30	5.16	0.49
		5.41	0.43
12.	Commercial whole drug, same as No. 10, above, except cleaned by motor brushing and powdered, No. 30	5.42	0.38
		5.45	0.30
13.	Commercial whole drug, same as No. 7, above, except cleaned by motor brushing and powdered, No. 30	4.31	0.31
		4.29	0.29
14.	Commercial whole drug, same as No. 6, above, except cleaned by motor brushing and powdered, No. 30	4.35	0.32
		4.48	0.20

15.	Commercial whole drug, same as No. 9, above, except cleaned by motor brushing and powdered, No. 30	4.13	0.42
		4.17	0.47
16.	Commercial whole drug, same as No. 8, above, except cleaned by motor brushing and powdered, No. 30	3.74	0.33
		3.76	0.35

DEPARTMENT OF PHARMACOGNOSY,
COLLEGE OF PHARMACY,
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THE VOLATILIZATION OF ETHYL NITRITE FROM SPIRIT OF NITROUS ETHER.*

BY J. G. ROBERTS.

An investigation to determine the cause of the deterioration of spirit of nitrous ether was instituted on account of the frequent prevalence of low strength samples which had, supposedly, been stored under normal conditions.

As shown by the following results deterioration is due to either the decomposition of, or to the volatilization of the ethyl nitrite. Decomposition is due to the action of light and volatilization to the action of heat, to the imperfect sealing of containers or to insufficiently filled containers. Carelessness or slowness in mixing the ethyl nitrite and alcohol is also a contributing factor. The latter cause can, however, be eliminated, particularly when a small quantity is prepared, by using the sealed tubes which contain sufficient ethyl nitrite, which when mixed with one pint of alcohol will produce spirit of nitrous ether of official strength.

Ethyl nitrite or nitrous ether as it was first named is a well-established product which has been well known for a considerable period. It was discovered by Kunkel as early as 1681 and was obtained by the reaction of nitric acid, alcohol and copper. It is a yellowish volatile liquid of a pleasant, ethereal odor, has a specific gravity of 0.990 at 15.5° C. and boils at 17° C. It is readily miscible with alcohol from which it is easily dissipated when not properly stored.

In the present method of manufacture, ethyl nitrite is produced by the reaction of sodium nitrite, sulphuric acid and alcohol. It is preferably made in a stoneware vessel of convenient size which is provided with a mechanical stirrer. The resulting gaseous ethyl nitrite is passed through a well-cooled condenser and collected in an ice-packed receiving vessel. As it is decomposed in the presence of water, particular care is taken to render it anhydrous.

Spirit of nitrous ether is a very popular article and judging from the attention given it, it has the greatest popularity among the various national, state and municipal authorities, who have made it a very frequent cause of investigation and examination. That their vigilance is justified is proven by the large number of cases of low quality sweet spirit of nitre that they have found. The ready volatility of its ethyl nitrite content has always been a disturbing factor and is a matter of deep concern to all those who take pride in the quality of the preparations they dispense.

According to modern chemical classification ethyl nitrite is an ester and not an ether. Its ethereal quality was probably the reason for the name or possibly on account of the discarded, inaccurate term "compound ether" that was formerly

*Read before Philadelphia Branch A. Ph. A., April meeting, 1921.

applied to this class of products. This inaccuracy should be corrected in the next revision of the United States Pharmacopoeia and the name "Spirit of Ethyl Nitrite" adopted. It would then be consistent and in uniformity with Spirit of Glyceryl Trinitrate which has been adopted for spirit of nitroglycerin.

With the object of determining the factor most responsible for the deterioration in quality, a number of experiments were conducted and the following results noted.

Experiment No. 1.

One-ounce flint and amber bottles were completely filled and placed in a refrigerator.

	Flint bottle, %.	Amber bottle, %.
Original strength	5.25	5.25
After keeping 4 weeks	5.22	5.23

Practically no change occurred in contents of either style of bottle when kept for this period under the above condition.

Experiment No. 2.

One-ounce flint and amber bottles were completely filled and kept in a dark closet at room temperature for four weeks.

	Flint bottle, %.	Amber bottle, %.
Original strength	5.25	5.25
After keeping 4 weeks	5.20	5.19

Very little change occurred in contents of either style of bottle.

Experiment No. 3.

One-ounce flint and amber bottles were completely filled and kept on shelf for four weeks.

	Flint, %.	Amber, %.
Original strength	5.25	5.25
After 1 week	5.24	5.25
After 2 weeks	5.24	5.23
After 3 weeks	5.24	5.22
After 4 weeks	5.07	5.19

Only a little change occurred in the amber containers and practically none in the flint containers until between the third and fourth weeks when a perceptible decrease in strength occurred. This peculiarity has been noted at various times and may be due to the presence of a foreign substance.

Experiment No. 4.

One pint was placed in a one-pint glass-stoppered bottle and examined weekly.

Original strength.	After 1 week.	After 2 weeks.	After 3 weeks.	After 4 weeks.
5.25%	5.1%	4.99%	4.96%	4.86%

This bottle was kept on a shelf under ordinary conditions. A progressive loss of about 0.4% for this period is noted.

Experiment No. 5.

A one-quart cork-stoppered bottle was filled and placed on shelf. Two ounces were taken out each day and the strength noted. The following results, given in order of their testing, were obtained on succeeding days: 5.22%, 5.22%, 5.22%, 5.18%, 5.16%, 5.1%, 5.07%, 5.11%, 5.01%, 4.95%, 4.90%, 4.7%, 4.57%, 4.62%, 4.04%. As the original strength was 5.25%, it is shown that a loss of 1.21% was suffered during that period. This test was conducted in order to parallel the conditions that exist when a large number of orders are filled from the same container.

Experiment No. 6.

Four ounces were placed in a pint bottle and kept on a shelf under ordinary conditions.

Original strength.	After keeping 1 day.	After keeping 21 days.
4.58%	3.92%	2.71%

The loss of 1.87% of ethyl nitrite during this period shows the inadivsability of placing a small quantity in a container that allows a large air space above the liquid.

Experiment No. 7.

One-ounce bottles were completely filled, then exposed to direct sunlight, and assayed weekly.

	Flint, %.	Amber, %.
Original strength	5.25	5.25
After one week	4.10	5.24
After two weeks	2.62	5.20
After three weeks	1.89	5.18
After four weeks	1.18	5.19

Results show surprisingly little change in the contents of amber bottles, and that the contents of the flint bottles show marked deterioration.

Experiment No. 8.

Desiring to determine the relative volatility of ethyl nitrite and alcohol when in admixture, 16 ounces were heated on a steam-bath. When a quantity equal to the amount of ethyl nitrite present had been driven off it was found to contain 2.5% ethyl nitrite which was a loss of 2.08%. Upon continuing the evaporation until all of the ethyl nitrite had been eliminated, it was found that 2.5 ounces had been vaporized, about 1.75 ounces of which were alcohol.

Experiment No. 9.

Exposure to the atmosphere in a porcelain evaporating dish.

Original strength.	After $^1/_2$ hour.	After 1 hour.	After $1^1/_2$ hours.
4.58%	1.4%	0.275%	0.038%

The pronounced volatility of the ethyl nitrite is well illustrated in this test which shows the elimination of practically all of it in $1^1/_2$ hours.

Experiment No. 10.

Exposure to the atmosphere and agitation in a porcelain dish.

Original strength.	After stirring 1 minute.	After stirring 3 min.	After stirring 5 min.
4.56%	3.58%	2.19%	1.54%

After stirring 10 minutes.	After stirring 15 minutes.
0.57%	0.19%

The rate of elimination was substantially increased by stirring, as most of the ethyl nitrite was dissipated in 10 minutes and practically all in 15 minutes.

As a result of this study we[1] find that ethyl nitrite is easily dissipated from an alcoholic solution; that the action of direct sunlight is very destructive to it in flint glass containers; that partly filled containers are objectionable and that it is bad practice to dispense numerous orders from the same container. The ideal method of storage is in small *completely filled*, amber bottles kept in a refrigerator or ice-box.

ANALYTICAL LABORATORY OF
SMITH, KLINE & FRENCH CO.

A CONTRIBUTION TO THE HISTORY OF THE DEVELOPMENT OF THE ENTERIC CAPSULE.

BY A. G. DUMEZ.

During the years 1914 and 1915, at least four articles concerning the hardening of gelatin capsules with formaldehyde appeared in American journals,

[1] The writer desires to express his appreciation of the services rendered by Mr. T. R. Singer in this investigation.

medical and pharmaceutical. These several articles appearing in such a short space of time, and the manner in which the subject was treated therein, would lead one to infer that the enteric capsule was of comparatively recent invention, and but little known to the medical profession. Such, however, is not the case.

The matter of preparing medicines intended for internal administration in such a manner that they might not be liberated until reaching the intestines has given rise to numerous investigations on the part of both the physician and the pharmacist. The first work along this line appears to have been done in connection with vile-tasting medicines which are liable to be regurgitated, or substances which, upon administration in the ordinary manner, give rise to gastric disturbances. The pill was the form of medication which appealed to the early investigators as offering the best means of solving this problem. Attempts were made to form the mass with the aid of some substances not acted upon by the gastric juice or to apply these substances to the exterior as a protective coating. Fats, waxes, resins, paraffin, collodion, salol, *et cetera*, were employed for this purpose, but with little avail, as disintegration in the stomach was only partially prevented or the pills passed intact through the intestines as well as the stomach. Such was the extent of the progress made in this matter up to the time of the introduction of keratin as a pill coating in the latter part of the 19th century.

At about this time, Dr. Unna[1] began experimenting with various pill coatings in an endeavor to discover a substance which, unlike the fats, did not depend for its usefulness upon its melting point, which would not be rendered soluble or be disintegrated by the acid secretion of the stomach and would still be soluble in the alkaline secretions of the intestines. The results of his investigations were published in 1884. As a result, there was made available to the practitioner the first real enteric pill, the keratin coated pill. Pills coated in this manner were marketed in Germany almost immediately under the name of "Keratinirte Pillen" or "Dündarmpillen." These were followed two years later by "Kapsulae keratinosae," or "Dündarmkapseln," which were also first placed upon the market in Germany.[2] In the case of the enteric capsule, however, the keratin was not applied as a coating, but was used as an ingredient of the material from which the capsule was formed. According to the patent[3] issued to the firm of G. G. Pohl of Schönbaum near Danzig, the mass used in making these capsules was prepared by mixing together the following:

(*a*) An ammoniacal solution of keratin evaporated to the consistence of a syrup.

(*b*) An aqueous solution of wax-free shellac and borax, also of the consistence of a syrup.

(*c*) A small amount of an ammoniacal solution of colophony.

The efficiency of the keratin coated pill and the keratinized capsule, however, seems to have been somewhat exaggerated in the beginning as certain disadvantages in the use of both were brought to notice later, when they became more generally known to the medical profession.

Dr. Sahli[4] of Berne, Switzerland, pointed out the fact that the efficiency of the

[1] *Pharm. Centralh.*, 25, 577, 1884; from *Fortschr. d. Med.*, 15, 507, 1884.

[2] *Pharm. Ztg.*, 31, 432, 1886.

[3] D. R. Patent No. 35976, November 1885.

[4] *Deutsch. Med. Wchnschr.*, 23, 62, 1897.

keratin coating, in the case of the pill, and of the capsule manufactured from keratinized material depended to a large extent on the contents of the pill or capsule, and that pills or capsules containing certain substances were prone to swell and burst before reaching the intestines. He, therefore, undertook to discover a means whereby this disadvantage might be overcome and intestinal medication further improved. Realizing that the capsule was of more practical value than the pill, he directed his efforts toward perfecting a process of hardening the ordinary gelatin capsule[1] in such a manner that it would withstand the solvent action of the gastric juice, regardless of the contents, and still be completely dissolved in the intestines. After several unsuccessful attempts, in which he employed tannin, catechu, kino, tannic acid, chromic acid, *et cetera*, as the hardening agent, he called to his aid the pharmacist Hausmann of St. Gallen, Switzerland. Hausmann apparently turned the work over to his assistant, Dr. Weyland.

Shortly before Dr. Weyland became interested in the subject, there appeared on the market a new antiseptic powder under the name of "Glutol."[2] Chemically, this substance was formalin gelatin. It appears that Dr. Weyland was informed as to the composition and properties[3] of this preparation and made use of the information in his attempts at hardening the ordinary gelatin capsule. At any rate, he employed an aqueous solution of formaldehyde for this purpose, and obtained results so satisfactory that the process was patented by Hausmann in 1895, and the capsules were marketed soon after under the name of "Glutoid-kapseln." The process as patented by Hausmann is as follows:[4]

> "Immerse the previously filled gelatin capsules for 18 minutes in an 0.8% aqueous solution of formaldehyde, wash with water and dry at 50° C."

The specifications state that the capsules thus treated dissolve in artificial pancreatic juice in 2 to 3 hours, that traces of uncombined formaldehyde may be removed by treatment with ammonia water, and that the degree of hardness may be varied by varying the strength of the formaldehyde solution or the length of the period of immersion.

Hausmann also secured a second patent[5] in which an aldehyde was employed as the hardening agent, namely, acrolein. The process, very similar to that given above, is described in the patent literature as follows:

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[1] The ordinary gelatin capsule was already in common use at this time. It was invented by Mothes, a Frenchman, in 1833. Mothes and Dublanc applied for a patent on the same in 1834. The first elastic capsule was made by Adolph Steeger, an apothecary of Bukarest, in 1843. *Apoth.-Ztg.*, 12, 275, 1897.

[2] "Formalin gelatin" or "formaldehyde gelatin" was first brought to the notice of the medical profession by Dr. Schleich of Berlin. He called the substance "Glutol." *Therap. Monatsh.*, 10, 608, 1896.

[3] Dr. Arnold Voswinkel published a short article on the composition and properties of "Glutol" in March 1896. In this article, he calls attention to the insolubility of the compound in dilute acids. *Pharm. Ztg.*, 41, 222, 1896.

Dr. Weyland in an article entitled "Ueber Formaldehydegelatine" published during the same year (1896), but later, mentions having seen the publication of Voswinkel, *Pharm. Centralh.*, 37, 483, 1896.

[4] D. R. Patent No. 85,807, August 1895.

[5] D. R. Patent No. 124,678, August 1895.

"Immerse the previously filled gelatin capsules for 10 to 20 minutes in a 0.5 to 1.0% aqueous solution of allyl aldehyde (acroleïn), wash and dry at 30° to 50° C."

It will be observed that in both of the above processes, it is necessary that the capsules be filled previous to immersing them in the hardening fluid. This was found to be an inconvenience in ordinary practice as considerable time was consumed in drying the capsules treated in this manner. Hardening the capsules previous to filling by immersing in the aqueous formaldehyde solution was found to be impracticable as they became distorted on drying and could not be properly closed. Furthermore, capsules treated according to Hausmann's method were found to increase in hardness with age, finally becoming insoluble in the intestinal as well as the gastric secretions.

The problem of hardening the empty capsule without detracting from its practical value or therapeutic efficiency is said to have been solved by Dr. Hans Rumpel of Breslau. The following are the specifications of his patent[1] taken out in 1904:

1. "Immerse the open capsules for 15 to 20 minutes in a sufficient quantity of a mixture consisting of 35 parts by weight of a 40% aqueous solution of formaldehyde and 2 parts by weight of 90 to 91% alcohol by volume. Dry at room temperature."
2. "Immerse the open capsules for 1/2 hour in a solution consisting of 2.5 kilos of acetone and 1 kilo of 35 to 40% aqueous solution of formaldehyde. Dry at room temperature."
3. "Immerse the open capsules for 10 minutes in a solution consisting of 1 kilo of a 40% aqueous solution of formaldehyde, 1 kilo of 90% alcohol and 2 kilos of ether. Dry at room temperature."
4. "Immerse the capsules for 20 minutes in a solution prepared by dissolving 80.0 grammes of chromic acid anhydride in 720 grammes of water and pouring the resulting solution slowly into 3.2 kilos of 90% alcohol. The solution should be chilled before immersing the capsules."

For Hardening Capsules Consisting of Two Parts.

"Immerse 500 of the opened capsules (20 mm. long × 5 to 6 mm. in dia.) for 1 to 1 1/2 minutes in 1000 grammes of a mixture consisting of 3 parts by weight of 35 to 40% aqueous formaldehyde solution and 10 parts by weight of 70% alcohol by volume. Remove the capsules from the liquid, spread out on blotting paper and dry at room temperature. After filling with the medicament, the capsules may be sealed by penciling with collodion or a solution of gelatin and again immersing in the formaldehyde solution."

Capsules treated according to Rumpel's process are at present being manufactured by the firm of Pohl in Schönbaum near Danzig[2] and are known in Europe as "Kapsulae geloderatae." In America, they are more commonly known as "Pohl's enteric capsules."[3] These capsules are, however, not for sale in the empty state, but are filled with various remedies and marketed by the firm of Pohl in the form of specialties.

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[1] D. R. Patent No. 167,318, October 1904.

[2] *Pharm. Centralh.*, 48, 256, 1907.

[3] *Drug. Circ.*, 58, No. 11, 64, 1914.

With the exception of the experiments of Vaudin, Donard and Labbé,[1] in 1906, on the use of concentrated solutions of maisin in alcohol or glacial acetic acid as the material for the manufacture of capsules, no further work along this line appears to have been attempted until the subject suddenly received attention in America in 1914. The American experimenters appear to have had no knowledge of the earlier work done in Europe, and the processes developed by them are, with one exception, similar to that patented by Hausmann as is shown by the following descriptions:

Method of Smith.[2]—"Immerse the filled capsules in a 10% aqueous solution of formaldehyde during 15 minutes. Wash in running water for 20 minutes and dry in a dish on a water-bath for 5 hours, or until free from the odor of formaldehyde."

Ballenger and Elder (Method No. 1).[3]—"Immerse the filled capsules for 1 minute in a dilution of 1 part of 40% formaldehyde solution to from 40 to 60 parts of water. The strength should vary with the aging allowed. From the time that the dilution mentioned is used, 2 weeks should be allowed to intervene before administering the capsules."

Ballenger and Elder (Method No. 2).[3]—"Place the capsules in an open box in a closed vessel in which they may be subjected to the vapor of Liquor Formaldehydi. About 15 Cc. of the solution should be used for each cubic foot of space in the closed vessel and should be placed on cotton or gauze in a saucer or tray. Six hours' exposure or less is sufficient for capsules which are not to be administered at once, while 12 hours may be necessary in preparing capsules for immediate use."

Method of DeLanney.[4]—"Number 00 capsules were soaked for a few hours in a 20% solution of formaldehyde and then dried. They became very brittle and somewhat distorted, but not so much as to prevent subsequent filling."

Method of Scoville.[5]—"Immerse the filled capsules for 30 seconds in a 1% aqueous solution of formaldehyde at ordinary temperature, drain them quickly, dry them, and store for 2 weeks before using."

Scoville calls attention to the fact that capsules treated as described by the American investigators increase in hardness with age and are unfit for use after about a year. Rumpel claims that capsules treated according to his process are not subject to this change. The final chapter in the history of the development of the enteric capsule, therefore, must be added at some future time.

HYGIENIC LABORATORY,
WASHINGTON, D. C.

GENERAL USES OF DISINFECTANTS.*

BY L. E. SAYRE.

Disinfectants are used for the prevention of germ activated waste. They are

[1] Maisin is prepared from corn by treating the ground material first with benzol to remove the fat and then digesting with hot amyl alcohol for 8 hours. The amyl alcohol extract is filtered and the maisin precipitated by adding 3 volumes of benzol. Maisin is stated to be more resistant to the acid secretions of the stomach than either keratin or glutin and, in concentrated solution, to be more easily moulded into capsules than gelatin. *Bull. Comm.*, 33, 465, through "Year-Book Pharm. and Trans.," p. 142, 1906.

[2] Cited by E. F. Cook, *Am. J. Pharm.* 86, 185, 1914.

[3] *J. Am. M. Assoc.*, 62, 197, 1914.

[4] *The Military Surg.*, 35, 320, 1914.

[5] *The Southern Pharm. J.*, 7, 745, 1915.

* Presented before Kansas Academy of Science, a contribution for public information.

destroyers of the bodies causing infectious diseases of animals, plants and foods. They are preventives of the growth and multiplication of noxious germs. They are destroyers of the microörganisms of disease already active in decomposition of organic matter.

These are essays towards a definition, but not a complete definition in the lot. One needs a definition applicable to each form or condition of perishable matter.

The universal, all-potent, omni-applicable disinfectant has not been devised or discovered.

If there are micro-bodies that can resist moderate boilings and prolonged intense freezings without destruction—that can withstand varied and various approved germicides, but which will succumb unresistingly to some one body discovered by patient research and innumerable experiments—the particular bodies selected and adapted to individual cases as disinfectants and germicides are patently very numerous. Dr. A. C. Walters has shown that there is a specificity in disinfectants; and, so, the universal, easily applied germ killing body is yet to be devised; the public that asks for such a preparation will have to go unsatisfied, and remain content with merely approximate remedies.

For a long time carbolic acid—phenol—was regarded as being almost omnipotent and efforts for improvement were in the line of searching for a body superior and more efficacious. When a chemical body was found that would slay its greater number of thousands it was welcomed exultantly. The mere counting of the dead was the test.

Yet again there are disinf[illegible]ich if compared with phenol efficiency would be found inert and worthless if thus superficially estimated, but on some given virulent organism they may be actively germicidal where the phenol itself is inert. And, reversely, a disinfectant which may compare favorably with phenol in some respects, is found wanting; when placed in general use its utility is almost nil. Specificity, therefore, is the most important factor in estimating the value of a disinfectant.

The original method of ascertaining the value of a disinfectant—that utilized by the Hygienic Laboratory—which did not carry its examination beyond its effect on a single or maybe a few microörganisms, is therefore shown to be an insufficient and faulty way of evaluation. Still, important and respected National Councils and States have sanctioned the Hygienic Laboratory method and many there are who will even now rely on its approvals, because they have not learned of the, then, undiscovered fallacies of the decisions arrived at.

The personal factor affects the determining manipulations of an observer. No two men will handle the test and the material tested equally efficiently. So hard and fast lines cannot be drawn in worth-comparisons—only relative judgments are possible.

Freedom of thought and action on the part of investigators must be less trammeled than it is. The dicta that "this is so" and "that is not so" when applied to general health, welfare or commerce, or manufactures, must be applied liberally or much injury will result in restraining progress. We plead for more freedom and less of the "hard and fast" restrictions, with, however, the reservation that all investigations should be made by the undeniably competent, the absolutely honest,

the actively constructive and perhaps the financially uninterested. There is no such thing as finality in research—there is always more beyond: The imposing of the letter of the law is frequently a branding that hurts and does not always protect. Dogma, for instance, has no place in a can of disinfectant.

Again a false sense of danger is given vent to by the restriction to unnecessarily small amounts of preservatives permissible in canned goods, for instance. Nature may normally utilize more of the same body or a variant of the article, unsuspectedly and freely, and such nature-guarded food is healthful and even craved. The hobbyist has occupied the saddle too long and too completely. When it has become patent that unnecessary restrictions have been made, a manly modification should be instituted even before the people sense the need of relief. A bureau of administration must also be a bureau of improvement. Laws should be interpreted by regulations. Wise regulations, changed to make them wiser when necessary, would strengthen any basic law which intentionally leaves regulations to official administrators.

Very efficient disinfectants are frequently of such a poisonous character that they cannot be used in connection with foods and beverages. The toxically inert but germicidally potent remedy is often the desideratum. We can treat a cesspool and care not how noxious the disinfecting agent is to human life, but if we wish to combat some of the germs existent in the human economy, which may infest the cesspool later—then the most good and service and the least, or no harm, is the desired quality.

In times of epidemics special measures for special uses have to be evolved. Infection must be resisted at every avenue of approach. Influenza prevailed for many winters and lingered and survived persistently in spite of all methods for attempting control. It had been conjectured and found that the necessary soda fountain was a dangerous disseminator of the disease. Even with scrupulous care and attention the infecting organisms would survive plain washing and rinsing of glasses and dishes. The danger was as present in the clean as in the carelessly conducted store. The drinks themselves fed the microörganisms. The persistent tacky glutinosity of syrups and fruits completely sealed up morbidity, so that perfunctory cleansing availed not. The Board of Health of Kansas, through its secretary, Dr. Crumbine, requested and requested vigorously that something be done to protect the public and inexpensively assist the soda dispenser. Boiling water and steam disinfection would involve a greater expenditure for cleaning a glass than the profit on the consumed drink afforded. Small stores would have to quit business if compelled to use that method. In response, and in connection with P. A. Patty, the writer plunged into the sea of trouble. The more or less uninjurious disinfectants were called to mind; many were dismissed at once on account of objectionable odor or taste. The substance must be hard working, rapid in action, and easily banished from the glassware. Sterility complete and unassailable must be secured in almost a flourish of the hand. The remembrance of the cheap but efficient Labarraque solution of hypochlorite clung persistently to our minds. Was there no way of making it the solution in quest?

Then came the tests. Laboratory work was planned and carried out. Three microörganisms were selected for the experiments: a culture of a micrococcus concerned in the genesis of boils and abscesses, a culture of the typhoid bacillus, and a

culture of the streptococcus causing sore throat and skin eruptions. The last mentioned is hard to kill. Every precaution was used to secure perfect taste—the smallest detail was observed—the speed used was purposely made the same as it would be in actually serving and selling glasses of soda water, and the cleansing afterward was performed before any drying process had taken place. Nineteen solutions were made and used. All contained available chlorine. The amount of free chlorine was not the only factor that determined efficiency. The solutions containing the greater amounts of free chlorine were no more efficient than those containing half or three-quarters less. The power depends also on the degree of alkalinity of the solution. Solution number 18, that in our test service was the nearest to neutrality but still alkaline, with only 0.05% of available chlorine in it, was the best. Hot water is not bactericidal in the time period practical. Addition of sodium salicylate added no power, although germicidal in itself. Solutions containing mercuric chloride are highly satisfactory as germicides but impractical on account of its highly poisonous character. The neutral bath, containing 1/20 of 1% of chlorine, killed all three of the microörganisms whether the bath was fresh or twenty-four hours old. Dip a recently water rinsed glass into the bath, allowing all parts to come in contact with the solution and sterilization is complete. A rinse in plain water and rapid drying finished the process.

*** *** ***

Few people can conceive how many natural disinfectants—antiseptics really they had better be called when used on living tissues—Mother Nature utilizes and for the same purposes. Years ago the writer took part in a discussion or controversy with other chemists, among them an esteemed co-worker, R. G. Eccles, M.D., of Brooklyn, N. Y., in which the claim was advanced that Nature in her normal processes formed antiseptic bodies as protective agents and for the insuring of reproduction and perpetuation.

Quite recently while investigating and estimating commercial disinfectants and sterilizers, the ideas formulated in the years before were vividly recalled. That time has strengthened the opinions then expressed was proved on my writing to Dr. Eccles to find if he also felt as conclusively on the matter as he had in previous days. Our combined views are nearly a perfect consensus, which I may present crudely.

There is no tissue, animal or vegetable, that does not contain to some degree the basic radicals that are the chemical nucleus of our chief organic antiseptics. Their abundance is greatest where destructive danger is greatest. In the proteins are familiar bodies containing the benzene or some derivative nucleus from which we get creosote, phenol, salicylic acid and benzoic acid. We carelessly class our synthetic antiseptics as being coal-tar products—of course coal tar is of vegetable origin and the proteins of the vegetables supplied the aromatic radicals now present in that coal tar. Plants produce their alkaloids and glucosides from these primary compounds. They are found richest in parts subject to destructive infection. Among them are amygdalin, gaultherin, salicin and tannin and they all give every indication of giving service protectively. In many seeds like plum, peach, apple, amygdalin is coupled with emulsin. Injury to these seeds does not affect the

glucosides until dampness favors fungoid or bacterial destructive growths; then the emulsin becomes active and releases benzaldehyde which soon oxidizes to benzoic acid. Small external damage receives a little of the antiseptic; larger wounds, a larger amount of the acid. In wintergreen and birch the protective glucoside is gaultherin which when reacted on by gaultheride is converted into the antiseptic methyl salicylate. To follow up further would be tiresome; suffice it to say that in all instances of the occurrence of glucosides and enzymes, the benzene ring plays its important part—the source that bestows antiseptic qualities.

We are now treating of present growths and their protective accompanying bodies; but if we apply the same principle to the past we reach the conclusion that if there had not been natural disinfectants we should not now have coal to burn. The only part of the vegetable material which made coal, that is preserved to us, is that part which was protected by the antiseptics from fungoid and other decay. Changed by heat and pressure and some chemical action, the portion that remains for our use and comfort was preserved and concentrated by the parts of the trees and plants that afforded the antiseptics. In the laboratory to-day from coal we reclaim these same nuclei and put them to further and similar uses.

To our senses the odors of plants residing in their essential oils mainly are very apparent and it is these aromatic principles that are the tissue preservers and the securers of reproductive processes. Some are simple at first, but become more complex and potent as they oxidize into new bodies, often losing their original characteristic odor and becoming nearly odorless but more efficient.

The practical use for antiseptics in food supplies is well known and appreciated. The extremists by baseless denunciations have made their use seem almost criminal. Interested propaganda by some manufacturers of some less perishable articles, widely advertised, has contributed to the scare, which ought never to have arisen. The practice of the housewife of adding certain simple bodies to "make things keep" has never hurt one, and has for generations afforded good summer food in cheerless winter days. It has long been known that cooked fruits and vegetables, cooked meat and fish, when exposed to warmth and non-sterile air, decompose more quickly than the same food will when perfectly fresh and under the same exposure. Fresh unheated foods resist infection longer because they self-contain aromatic radicals easily released by cell enzymes to preserve the food. Heat-sterilized foods are ideal for the propagation of putrid growths. That is why the manufacturer instructs one to take contents from the can and if any portion is unused to keep it refrigerated. The heat used in canning destroys nature's protecting agents—why should not the preservatives be restored to a reasonable extent before sealing after sterilization is complete? The extremists have at times given people to understand that it was possible that salt and other innocent substances which have been used domestically since meats were first preserved would be forbidden to be used by packers. To be consistent the hobbyists should prevent the smoking of hams, bacon, fish, sausage and the like because of the many (empyreumatic) products generated and absorbed—creosote, acetic acid and unknown chemical combinations that have given us the harmless and dainty foods for generations. Dr. Ecoles says that strength for strength in antiseptic power benzoic and salicylic acids are very much less harmful than salt or vinegar but our food dictators would hold up their hands in horror if these were put into use.

Perhaps it will now be seen why we fear that progress will be hindered, commerce unreasonably hampered and restricted by unwise theorists who would cling to their shibboleth of law though the nation should starve. If Nature's processes are in themselves largely self-preserving and of proven innocence, why cannot there be a greater leeway afforded to manufacturers who would have to disclose their formulas and if not generally approved offer themselves up to destructive and ruining criticism?

The burden of this rather excursive consideration of antiseptics may be given briefly: there is no intention of advocating unnecessary and indiscriminate use of antiseptics in the preservation of foods, but the point is emphasized that if we legally and commercially discourage and make unpopular the study of antiseptics for the purpose mentioned we are absolutely hindering progress. In this day and age when the transportation of food products immense distances is of vital importance, we should rather offer rewards and encouragement for research of this character than to practically condemn such work by greeting it with chilly indifference or faint praise.

CAUSE OF DELAY.

The delay of the May number of the JOURNAL A. PH. A. was caused by a printers' strike; though this is not ended, the conditions are such that the intervals between the succeeding issues will soon be adjusted, and it is hoped the August number will be mailed on the regular date, the preceeding issues as near the mailing dates as possible.—THE PUBLICATION COMMITTEE.

PHARMACEUTICAL FORMULAS

PROPOSED FOR "UNOFFICIAL FORMULAS, A. PH. A."

The formulas heretofore published will be found in Volume I, JOURNAL A. PH. A., pp. 169, 366, 505, 637, 760, and 1307; Volume V, pp. 309, 422, 529, 631, 748, 862, 991 (see also p. 1129), 1126, 1265, and 1397; Volume VI, pp. 79, 194, 298, 393, 486, 563, 643, 729 and 823.

For list of committee members and committees see April issue, p. 292. Suggestions for formulas, and comments on those published, are invited. They may be sent to a member of the committee or to Chairman J. Leon Lascoff, 1223 Lexington Ave., New York, N. Y.

FORMULAS.

No. 655.

KUMMERFELD'S LOTION.

Spirit of Camphor	10.0	Cc.
Alcohol	10.0	Cc.
Tragacanth	1.5	Gm.
Precipitated Sulphur	6.0	Gm.
Distilled Water	100.0	Gm.

Mix; agitate frequently during forty-eight hours. Dispense with a "Shake Well" label.

Contributed by J. K. Thum.

II.

KUMMERFELD'S LOTION.

Precipitated Sulphur	40.00	Gm.
Camphor	3.33	Gm.
Acacia	6.66	Gm.
Solution of Calcium Hydroxide	500.00	Cc.
Rose Water, a sufficient quantity,		
To make	1000.0	Cc.

Contributed by C. P. Wimmer.

See also p. 169, Volume I, J. A. PH. A., 1912.

No. 656.

COMPOUND ACNE LOTION (STETSON HOSPITAL FORMULARY).

Precipitated Sulphur	300.0	Gm.
Zinc Oxide	300.0	Gm.
Casein	100.0	Gm.
Water	400.0	Cc.
Spirit of Camphor	200.0	Cc.

No. 657.

CORN REMEDY (COLORLESS).

Acid Salicylic	20.0	Gm.
Glacial Acetic Acid	100.0	Cc.
Celluloid	50.0	Gm.
Camphor	50.0	Gm.
Castor Oil	25.0	Cc.
Acetone, a sufficient quantity,		
To make	1000.0	Cc.

Shred the celluloid and dissolve it in the warmed acetic acid. Dissolve the camphor and salicylic acid in the acetone. Mix the two solutions, then add the castor oil.

See also p. 1129, Volume V, J. A. PH. A., 1916.

No. 658.

FACE POWDER.

Zinc Oxide	100.0	Gm.
Magnesium Carbonate, light	100.0	Gm.
Talcum	200.0	Gm.
Zinc Stearate	600.0	Gm.

If desired, color with an alcoholic solution of eosin, 1:100. Perfume to suit.

See also p. 992, Volume V, J. A. PH. A., 1916.

No. 659.

LIQUID ANTISEPTIC SOAP.

Cottonseed Oil	300.0	Gm.
Alcohol	200.0	Cc.
Water	450.0	Cc.
Sodium Hydroxide	45.0	Gm.
Potassium Carbonate	10.0	Gm.
Ether	15.0	Cc.
Liquefied Phenol	25.0	Cc.

Add a mixture of 100 Cc. water and 200 Cc. alcohol to the oil, mix thoroughly.

Dissolve the sodium hydroxide and the potassium carbonate in 325 Cc. of water; add this solution to the oil mixture. Lastly add the ether and phenol.

Contributed by Mrs. M. A. Davis.

See also p. 173, Volume I, J. A. PH. A., 1912.

No. 660.

ROEMER'S ANTIFORMIN.

Solution of Chlorinated Potassa	50	Cc.
Sodium Hydrate, 15% aqueous solution	50	Cc.

Mix the two solutions.

No. 661.

DOUCHE POWDER.

Alum, powdered	30.0	Gm.
Boric Acid	120.0	Gm.
Liquefied Phenol	12.0	Cc.
Methyl Salicylate	6.0	Cc.

Mix the alum and boric acid, add the phenol and methyl salicylate; and triturate thoroughly.

For use—Dissolve 4 Gm. of the powder in 1000 Cc. of water.

No. 662.

EMULSION OF COD LIVER OIL WITH HYPOPHOSPHITES.

Mucilage of Irish Moss	450.0	Cc.
Cod Liver Oil	400.0	Cc.
Calcium Hypophosphite	10.0	Gm.
Sodium Hypophosphite	5.0	Gm.
Potassium Hypophosphite	5.0	Gm.
Syrup of Citric Acid	100.0	Cc.
Water, a sufficient quantity,		
To make	1,000.0	Cc.

OIL MIXTURE FOR FLAVORING.

Oil of Lemon	40	Cc.
Methyl Salicylate	5	Cc.
Oil of Bitter Almond	5	Cc.

MUCILAGE OF IRISH MOSS.

Chondrus	270	Gm.
Water, a sufficient quantity,		
To make	9000	Cc.

Thoroughly wash the Chondrus with cold water; place it in a suitable vessel. Add 1000 Cc. of water, heat on a water-bath for thirty minutes, stir frequently. Allow to stand 12 hours; strain through muslin using pressure; pass sufficient water through the strainer to make the product measure 9000 Cc.

Make an emulsion with the mucilage and cod liver oil; add the hypophosphites, dissolved in a sufficient amount of water, then the syrup of citric acid. When thoroughly mixed, add the oil mixture for flavoring.

Dose—Tablespoonful, about one-half hour before meals, for adults.

No. 663.

LAXATIVE SYRUP.

Aromatic Fluidextract of Cascara	250.00	Cc.
Potassium and Sodium Tartrate	167.15	Gm.
Syrup, a sufficient quantity,		
To make	1,000.00	Cc.

Heat the fluidextract on a water-bath until all the alcohol is evaporated. Dissolve the tartrate in 500 Cc. of syrup. Mix this solution with the extract, then add enough syrup to make the product measure 1000 Cc.

Dose—A teaspoonful at bedtime.

No. 664.

NASAL DROPS (BIRCH).

Liquid Petrolatum	60.00	Cc.
Oil Eucalyptus	0.60	Cc.
Oil of Pine	0.60	Cc.
Menthol, 10%	0.020	Cc.

Dissolve the menthol in the liquid petrolatum and add the oils.

Direct to apply to the nares with a dropper or a pledget of cotton.

No. 665.

WHITE COUGH MIXTURE.

Sodium Benzoate	8.0	Gm.
Aromatic Elixir	15.0	Cc.
Water, a sufficient quantity,		
To make	60.0	Cc.

Dose—A teaspoonful every two hours until relieved.

No. 666.

PILE OINTMENT (WALKER'S).

Ointment of Zinc Oxide	12.00	Gm.
Mild Mercurous Chloride	1.36	Gm.
Lead Acetate	1.36	Gm.
Hydrous Wool Fat, a sufficient quantity,		
To make	30.00	Gm.

Rub the mild mercurous chloride and lead acetate into a smooth ointment with the ointment of zinc oxide, then incorporate the wool fat.

See also p. 532, Volume V, J. A. PH. A., 1916.

No.667.

BIJOU CLEANING FLUID.

Methyl Salicylate	4.0	Cc.
Chloroform	8.0	Cc.
Ether	4.0	Cc.
Benzine, a sufficient quantity,		
To make	500.0	Cc.

Thoroughly brush the garment to be cleaned. Saturate a cloth (if possible of like material as the garment) with the cleaning fluid; apply and rub with a circular movement.

(*Concluded in June issue.*)

BIBLIOGRAPHY OF PHARMACEUTICAL RESEARCH

Conducted by H. V. Arny, Reporter on the Progress of Pharmacy, Chairman of the Committee on Research.

On these pages, each month, will be found a list of articles on pharmaceutical research that appear in the pharmaceutical and other scientific journals of the world. Whenever possible, the list appearing a certain month will record articles appearing in American journals of the preceding month and articles appearing in foreign journals will be recorded as quickly as possible after the journals reach the Reporter.

All articles appearing in these lists will be presented in abstract form in the bound volumes of the YEAR BOOK, which will be issued as soon after the end of the year represented as editing and printing conditions permit. Those desiring abstracts immediately can obtain same for a fee of one dollar each by communicating with H. V. Arny, 115 West 68th St., New York, and arrangements can also be made for securing photographic reproduction of entire articles at moderate prices when such are desired.

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A new stain for bacilli tuberculosis
Dtsch. Med. Wschr.; through *Pharm. Weekbl.*, 58 (Mch. 12, 1921), 310
Masters, Helen, and Garbutt, Phyllis
Color changes in cooking vegetables
Biochem. J.; through *Pharm. J.*, 106 (Mch. 12, 1921), 193
Pahl, W.
Detection of oxalates in plant tissues
Z. wiss. Mikroscop.; through *Pharm. Zent.*, 62 (Feb. 24, 1921), 115
Ronge, E.
Assimilation of carbon dioxide by plants
Schweiz. Apoth.-Ztg., 59 (Mch. 17, 1921), 1581, and (Mch. 24, 1921), 175
Van Wisselingh, C.
Study of various seed-coats
Pharm. Weekbl., 58 (Mch. 12, 1921), 298, and (Mch. 19, 1921), 326

THERAPEUTICS AND NEW REMEDIES.

Freeman, J.
Toxic iodiopathy
Pharm. J., 106 (Mch. 19, 1921), 215

VEGETABLE AND ANIMAL MATERIA MEDICA.

Asahina, Y., and Motigasi, S.
Alkaloids of Corydalis decumbens
J. Pharm. Soc. Japan; through *J. pharm. chim.*, 23 (Feb. 16, 1921), 142

Beal, J. H.
Therapeutics of echinacea
J. Agr. Res.; through *Am. J. Pharm.*, 93 (Mch. 1921), 229

Boruttau, H., and Cappenberg, H.
Active constituents of shepherd's purse
Arch. Pharm., 259 (Mch. 12, 1921), 33

Briggs, W. P.
Scammony
Nat. Drug., 51 (Apr. 1921), 194

Burns, W. C.
Moisture content of aromatic drugs
J. Am. Pharm. Assoc., 10 (Apr. 1921), 272

Chestnut, V. K.
Papain
J. Assoc. Off. Agric. Chem.; through *J. Soc. Chem. Ind.*, 40 (Feb. 28, 1921), 128A

Couch, J. F., and Giltner, T.
Therapeutics of echinacea
J. Agr. Res.; through *Am. J. Pharm.*, 93 (Mch. 1921), 227

Emanuel, E., and Papavasilion, M.
Constituents of the seeds of Plantago coronopus
Arch. Pharm.; through *J. pharm. chim.*, 23 (Mch. 1, 1921), 181

Gorter, K.
Hiptagin from Hiptage madablota
Bull. Jard. Bot. Buitenzorg; through *J. pharm. chim.*, 23 (Jan. 16, 1921), 62

Gorter, K.
Hyotolide from Hyptis pectinata
Bull. Jard. Bot. Buitenzorg; through *J. pharm. chim.*, 23 (Jan. 16, 1921), 61.

Gorter, K.
Sources of lycorine
Bull. Jard. Bot. Buitenzorg; through *J. Soc. Chem. Ind.*, 40 (Mch. 31, 1921), 193A

Grant, E. H.
Determination of fiber in gum karaya
J. Am. Pharm. Assoc., 10 (Apr. 1921), 270

Holmstrom, J. J.
Constituents of Rheum Emodi
Schweiz. Apoth.-Ztg., 59 (Mch. 24, 1921), 169, and (Mch. 31, 1921), 183

Jensen,
Standardizing thyroid preparations
Hospitalstidende; through *Pharm. Era*, 54 (Apr. 1921), 143

Joachimovitz,
Primula root
Z. oesterr. Apoth.-Ver.; through *Pharm. Weekbl.*, 58 Feb. 28, 1921), 242

Juul,
Adulterated polygala
Farm. Tid.; through *Pharm. Zent.*, 62 (Mch. 17, 1921), 165

Karrer, P., Karrer, W., and Chao, J. C.
Glycyrrhiza
Helv. Chim. Acta; through *J. Soc. Chem. Ind.*, 40 (Mch. 31, 1921), 194A

Kochmann,
Therapeutics of shepherd's purse
Pharm. Ztg., 66 (Jan. 19, 1921), 61

Kondo, H., and Amano, U.
Constituents of Korean ginseng
J. Pharm. Soc. Japan; through *Pharm. Zent.*, 62 (Mch. 24, 1921), 171

Mitchell, D.
Drug plant cultivation at Inverness
Pharm. J., 106 (Mch. 26, 1921), 232

Nakao, M.
Constituents of Selinum Monnieri
J. Pharm. Soc. Japan; through *J. pharm. chim.*, 23 (Feb. 16, 1921), 141

Orient, J.
Ratio of alkaloid to nitrogen content in belladonna
Pharm. Monatsh.; through *Pharm. Ztg.*, 66 (Mch. 23, 1921), 257

Renon,
Passiflora as hypnotic
J. Pharm. Belg.; through *Pharm. Era*, 54 (Apr. 1921), 143

Schomer, A.
Assay of yohimbin in yohimbe bark
Pharm. Zent., 62 (Mch. 24, 1921), 169

Schoorl, N., and Gerritzen, S. C. L.
Moisture content of milk powder
Pharm. Weekbl., 58 (Mch. 26, 1921), 370

Thevenon, L.
Detecting acacia in powdered tragacanth
Ann. falsif.; through *Pharm. Ztg.*, 66 (Mch. 23, 1921), 257

Ugarte, T.
Rapid assay of morphine in opium
J. pharm. chim., 23 (Feb. 16, 1921), 129

Wattiez, N.
Plantago Bistorta as astringent drug
J. Pharm. Belg.; through *J. pharm. chim.*, 23 (Mch. 1, 1921), 181
Wolff, H.
Testing Peru balsam
Pharm. Ztg., 66 (Jan. 12, 1921), 38
Zechmeister and Szecsi, P.
Fumaric acid and inositol from shepherd's purse
Ber.; through *J. Soc. Chem. Ind.*, 40 (Mch. 15, 1921), 161A

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Bertiaux
Standardizing volumetric solutions
Bull. Soc. Chim.; through *Drug. Circ.*, 65 (Apr. 1921), 142
Browne, Frank
Radium and atom structure
Pharm. J., 106 (Mch. 26, 1921), 241
Corrigan, J. F.
Luminescence in inorganic bodies
Chem. News (Mch. 24, 1921), 133
Rutherford, E.
Electricity and matter
Pharm. J. (Mch. 19, 1921), 215
Tansley, L. B.
Spiral classification of the elements
Chem. News, 122 (Mch. 18, 1921), 121
Wright, C. H.
Influence of temperature on the refractive index
Chem. Umschau; through *Pharm. Zent.*, 62 (Mch. 17, 1921), 161

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Asahina, Y., and Fugita, A.
Action of acids and alkalies on ammonium
J. Pharm. Soc. Japan; through *J. pharm. chim.*, 23 (Jan. 16, 1921), 58
Cowley, R. C., and Palmer, E. H.
A new method for making hydrobromic acid
Nat. Drug., 50 (Apr. 1921), 197
Dahse, W.
Increasing adhesive power of water-glass
Drug. Ztg.; through *Pharm. Zent.*, 62 (Mch. 31 (1921), 192
Drawe, P.
Analysis of gold alloys
Z. angew Chem.; through *Pharm. Ztg.*, 66 (Jan. 26, 1921), 86
Eder
Welsium
Süddtsch. Apoth.-Ztg.; through *Pharm. Zent.*, 62 (Mch. 17, 1921), 160
Éwe, G. E.
Emetine bismuth iodide
J. Am. Pharm. Assoc., 10 (Apr. 1921), 261
Formhals
Volumetric assay of hydrosulphites
Chem.-Ztg.; through *Drug. Circ.*, 65 (Apr. 1921), 142
Herschkowitz, M.
Separation of chromium and manganese
Z. anal. chem., 58 (Mch. 26, 1921), 383
Hüsgen, H.
A lipotropic mercury compound
Biochem. Zschr.; through *J. Soc. Chem. Ind.*, 40 (Feb. 28, 1921), 128A
Kolthoff, I. M.
Adsorption of silver mercury and other metals
Pharm. Weekbl., 58 (Feb. 28, 1921), 233
Kolthoff, I. M.
Iodometric assay of chromic acid
Z. anal. Chem.; through *J. Soc. Chem. Ind.*, 40 (Mch. 15, 1921), 165A
Lansquet
Purifying hydrochloric acid
Bull. soc. chim. Belg.; through *Pharm. Zent.*, 62 (Mch. 31, 1921), 193
Nakao, M.
Manganese peroxide and its sulphate
J. Pharm. Soc. Japan; through *J. pharm. chim.*, 23 (Jan. 16, 1921), 57
Sarma, V. V.
Curpous oxides by reduction
Chem. News, 122 (Mch. 4, 1921), 99
Schanz, R. F.
Iodide and bromide pastes in X-ray work
J. Am. Med. Assoc.; through J. Am. Pharm. Assoc., 10 (Apr. 1921), 263
Voigt, J., and Corinth, M.
Colloidal silver iodide
Therap. Gegenw.; through *Pharm. Zent.*, 62 (Mch. 17, 1921), 166
Winkler, L. W.
Arsenic tests
Pharm. Zent., 62 (Mch. 3, 1921), 125
Winkler, L. W.
Sulphuric acid assays
Z. angew Chem.; through *Pharm. Ztg.*, 66 (Jan. 26, 1921), 84

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Achard, C., and Feuillee, E.
Detecting albumosis in organic material
Compt. rend. Soc. Biol.; through *J. pharm. chim.*, 23 (Feb. 16, 1921), 146

Alpers, K.
Testing castor oil
Pharm. Ztg., 66 (Mch. 19, 1921), 243

Anderson, R. J.
Inositol phosphoric acids
Bull. N. Y. Exp. Stat.; through *J. Soc. Chem. Ind.*, 40 (Mch. 31, 1921), 194A

Bardet, D.
Diethyl-diallyl barbiturate of diethylamine
J. pharm. chim., 23 (Feb. 16, 1921), 157

Bauer, K. H., and Schoder, F.
4,7-dioxy coumarin
Arch. Pharm., 259 (Mch. 12, 1921), 53

Bertolo
Lemonseed oil
Gior. Chim. Ind.; through *J. Soc. Chem Ind.*, 40 (Mch. 15, 1921), 153A

Bougault, J., and Robin, P.
Catalytic oxidation of unsaturated bodies
J. pharm. chim., 23 (Jan. 16, 1921), 49

Bridel, M., and Arnold, R.
Precipitants for emulsin from almonds
J. pharm. chim., 23 (Mch. 1, 1921), 161

Cordebard
Assay of organic chemicals with chromic mixture
Ann. chim. anal.; through *Pharm. Zent.*, 62 (Mch. 24, 1921), 174

Dott, D. B.
Quinine acetylosalicylsulphate
Pharm. J., 106 (Mch. 26, 1921), 232

Dulière
Oil of mustard
J. Pharm. Belg.; through *Pharm. Era*, 54 (Apr. 1921), 142

Eschbaum, F.
Tests for denatured alcohol
Pharm. Ztg., 66 (Jan. 5, 1921), 17

Freund, M., and Speyer, E.
Reduction products of thebaine
Ber.; through *J. Soc. Chem. Ind.*, 40 (Feb. 28, 1921), 127A

Geret
Detection of coumarin in vanillin
Am. Perf.; through *Drug. Circ.*, 65 (Apr. 1921), 141

Horrmann, P., and Behschmidt
Properties of brompicrotoxin
Arch. Pharm., 259 (Mch. 12, 1921), 69

Horrmann, P., and Hagedorn, M.
Decomposition of alphapicrotinic acid
Arch. Pharm., 259 (Mch. 12, 1921), 7

Huerre, R.
Action of halogenacids on oil of Juniperus oxycedrus
J. pharm. chim., 23 (Feb. 1, 1921) 1, 81

Jonascu and Vargalici
Assay of reducing sugars
Bull. Soc. Chem. Romana; through *Drug Circ.*, 65 (Apr. 1921), 141

Kariyone, T., and Atsumi, K.
Assay of thymol in oil of Mosla japonica
J. Pharm. Soc. Japan; through *J. pharm. chim.*, 23 (Feb. 16, 1921), 148

Karrer, P., and Widmer, F.
Synthesis of aspidinol
Helv. chim. Acta; through *J. pharm. chim.*, 23 (Jan. 16, 1921), 62

Karr, W. G.
Vitamine, appetite and digestion
J. Biol. Chem.; through *Pharm. J.*, 106 (Mch. 19, 1921), 212

Ketmatsu, S.
Constituents of oil of chaulmoogra
J. Pharm. Soc. Japan; through *J. pharm. chim.*, 23 (Jan. 16, 1921), 56

Klasen
Compostition of lignin
Chem. Umschau; through *Pharm. Zent.*, 62 (Mch. 31, 1921), 193

Kremers, R. E.
Distillation of aqueous distillates from the production of volatile oils
Bull. Univ. Wisc.; through J. Am. Pharm. Assoc., 10 (Apr. 1921), 318

Kremers, R. E.
Volatile oil of milfoil
J. Am. Pharm. Assoc., 10 (Apr. 1921), 252

Kunz-Krause, H.
Insoluble material in volatile oil of mustard
Arch. Pharm., 259 (Mch. 12, 1921), 16

Langer, A.
Test for oil of chenopodium
Pharm. Ztg., 66 (Mch. 2, 1921), 191

Lührig, H.
Polarimetric starch determination
Pharm. Zent., 62 (Mch. 10, 1921), 141

Malmy, M.
Distinguishing theobromine from caffeine
J. pharm. chim., 23 (Feb. 1, 1921), 89

Manseau, M. A.
Distinguishing between cocaine and stovaine
Bull. Soc. Pharm. Bordeaux; through *Am. J. Pharm.*, 93 (Mch. 1921), 236

Martin, F.
Acetylization assay of borneol
J. pharm. chim., 23 (Mch. 1921), 168

McGill, W. J.
Digitalis saponins
J. Am. Pharm. Assoc., 10 (Apr. 1921), 266
Merck, E.
So-called "artificial oil of chenopodium"
Pharm. Ztg., 66 (Mch. 9, 1921), 214
Mignonac, G.
Preparing amines from aldehydes and ketones
Comptes rend.; through *J. Soc. Chem. Ind.*, 40 (Mch. 31, 1921), 194A
Mueller, E., and Rius y Miro
Methane by electrolysis
Z. Elektrochem.; through *J. Soc. Chem. Ind.*, 40 (Mch. 31, 1921), 194A
Nutter
Detecting salicylic acid in acetylsalicylic acid
Analyst; through *Drug. Circ.*, 65 (Apr. 1921), 142
Pictet, A.
Structure of alpha and beta glucoses
Helv. Chim. Acta; through *J. pharm. chim.*, 23 (Mch. 1, 1921), 186
Polinski, M.
Detection of formic acid in acetic acid
Chemist-Analyst; through *Am. J. Pharm.*, 93 (Mch. 1921), 236
Posternack, S.
Inositol hexaphosphate
Helv. Chim. Acta; through *J. Soc. Chem. Ind.*, 40 (Mch. 31, 1921), 194A
Pouchet, M.
Allyl theobromine
Gaz. Hopitaux; through *Pharm. Era*, 54 (Apr. 1921), 141
Pritzker, J., and Jungkunz, R.
Examination of birch tar oils
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Rabe, R.
Tests for denatured alcohol
Pharm. Ztg., 66 (Jan. 22, 1921), 72
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Arch. Pharm., 259 (Mch. 12, 1921), 1
Reutter, L.
Alkaloidal extraction
Farmacia; through *Pharm. Era*, 54 (Apr. 1921), 141
Reutter de Rosemont, L.
Purification of cocaine
Bull. Sci. Pharmacol.; through *J. Soc. Chem. Ind.*, 30 (Mch. 31, 1921), 193A
Rodillon, G.
New phenol test
J. pharm. chim., 23 (Feb. 16, 1921), 136
Sabalitschka, T.
Decomposition of dicarbonic acids in water
Ber.; through *Pharm. Ztg.*, 66 (Jan. 26, 1921), 85
Sayer, A. E.
Preparing pyroxylin
Nat. Drug., 51 (Apr. 1921), 204
Schneider, W., and Schroeter, K.
Aceto-papaverine and coralyn
Ber.; through *Pharm. Zent.*, 62 (Feb. 24, 1921), 114
Sollman, T.
Precipitation of proteins by tannin
J. Pharmacol. Exp.; through *J. Soc. Chem. Ind.*, 40 (Feb. 28, 1921), 128A
Stoermer, R., and Laage
Truxillic and truxinic acids
Ber.; through *J. Soc. Chem. Ind.*, 40 (Mch. 15, 1921), 161A
Sugii, Y.
Preparation of dioxyphenylalanin
J. Pharm. Soc. Japan (Feb. 12, 1921), 130
Takea, J., and Kuroda, S.
Preparation of alkamines
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Tiffeneau and Bouchereau
Diphenate of tetramethylenamine
L. Union Pharm.; through *Pharm. Era*, 54 (Apr. 1921), 142
Tommasi
Lawson, the active principle of henna
Gaz. chim. ital.; through *Drug Circ.*, 65 (Apr. 1921), 142
Utz
Color test for fatty oils
Chem. Ind.; through *Pharm. Zent.*, 62 (Mch. 24, 1921), 173
Von Steinau
Bleaching fatty oils
Chem. Umschau; through *Pharm. Zent.*, 62 (Mch. 31, 1921), 194
Warren, L. E., and Clark, A. H.
Separation of strychnine from quinine
J. Am. Pharm. Assoc., 10 (Apr. 1921), 267
Wiesse, Hilda
Standards for medicinal pine oil
J. Am. Pharm. Assoc., 10 (Apr. 1921), 318
Willstätter, R., and Bommer, M.
Production of formaldehyde from ethylene
Ann.; through *J. Soc. Chem. Ind.*, 40 (Feb. 28, 1921), 128A

Willstätter, R., and Bommer, M.
Synthesis of ecgonine and tropinone
Ann.; through *J. Soc. Chem. Ind.*, 40 (Feb. 28, 1921), 127A
Wischo, F.
Baljet's test for digitalis glucosides
Z. oesterr. Apoth.-Ver.; through *Pharm. Zent.*, 62 (Feb. 24, 1921), 119
Wolff, H.
Detection of glycol in glycerin
Chem. Umschau; through *Pharm. Zent.*, 62 (Feb. 24, 1921), 116
Yoshitomi, E., and Watanabe, K.
Bromural
J. Pharm. Japan (Feb. 1921), 125
Zimmerman
Distinguishing synthetic from natural camphor
Apoth. Ztg.; through *Drug. Circ.*, 65 (Apr. 1921), 141
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Glycerin tests
Apoth. Ztg.; through *Drug. Circ.*, 65 (Apr. 1921), 141

COUNCIL BUSINESS

A. PH. A. COUNCIL LETTER NO. 16.

(Abstract.)

WASHINGTON, D. C., March 30, 1921.

70. *Additional appropriation for the Year Book* (*Item 68*).

71. *Request that a set of the Proceedings be sent to the Pharmaceutical Institute of the University of Berlin and certain volumes to the University of Basel—Result of vote.* Motion No. 69, a motion to grant the request of Prof. Edward Kremers relative to the supplying of the Pharmaceutical Institute of the University of Berlin with a set of the Proceedings of the A. Ph. A., and the University of Basel with the numbers to complete its set, has received a majority of affirmative votes.

72. *Resignation of Chairman of the Committee on Standards of Drugs and Chemical Products* (*Item 64*). No action has been taken on the resignation of Prof. J. A. Koch as chairman of the above-mentioned committee.

73. *Election of Active Members.* You are requested to vote on the following applications for active membership:

No. 440, John R. Bouèe, 1323 Bienvele St., New Orleans, La.; No. 441, Smith C. Wilson, 143–145 N. 9th St., Lincoln, Nebr.; No. 442, Edward Hays Rutledge, 1100 W. 37th St., Chicago, Ill.; No. 443, Dwight Beach Shaw, Stilwell, Okla., S. & S. member.; No. 444, Leo Armand Beaulac, 532 Park Ave., Worcester, Mass.; No. 445, Dr. Edward Clarence Reif, 1203 Resaca Place, Pittsburgh, Pa.; No. 446, Chas. H. Hirsch, 2558 Southport Ave., Chicago, Ill.; No. 447, Frank M. Allen, 555 Adams Ave., E., Detroit., Mich.; No. 448, Raymond A. Leach, 4836 West End Ave., Chicago, Ill.; No. 449, Hallie Chris Seawell, Medical College of Va., Richmond, Va.; No. 450, Lloyd R. Moyer, 141–145 N. 1st St., Care First National Pharmacy, Lehighton, Pa.; No. 451, Edward F. Antonides, 2620 W. 26th St., Chicago, Ill.; No. 452, Edward Sykora, 2341 S. Clifton Pk. Ave., Chicago, Ill.; No. 453, August Charles Flach, 2400 Washington Ave., New Orleans, La.; No. 454, Fred Besse, Jr., 1244 Magazine St., New Orleans, La.; No. 455, Julius Frederick Just, 616½ S. Galena Ave., Freeport, Ill.; No. 456, Charles E. Wilson, 1024 Taylor St., Corinth, Miss.; No. 457, Robert Edson Bemis, 87 Homer St., East Boston, Mass.; No. 458, Abraham Kohl, 151 Bowers St., Jersey City, N. J.; No. 459, Archibald Victor Kerr, 1024 Ky. Street, Lawrence, Kans.

A. G. DUMEZ, *Secretary.*

A. PH. A. COUNCIL LETTER NO. 17.

(Abstract.)

WASHINGTON, D. C., April 14, 1921.

74. *Additional appropriation for the Year Book—Result of vote.* Motion No. 70 has received a majority of affirmative votes.

75. *Resignation of Chairman of the Committee on Standards of Drugs and Chemical Products* (*Items Nos. 64 and 72*). To date, no action has been taken on Prof. Koch's resignation tendered February 21, 1921.

76. *Election of active members—Result of vote.* Motion No. 73 has received a majority of affirmative votes.

77. *Election of active members.* You are requested to vote on the following applications for active membership:

No. 460, Mary Ellen Correia, 1730 41st Ave., Oakland, Calif.; No. 461, Glen O. Fruide, 885 No. 25th St., Lincoln, Nebr.; No. 462, David B. Ray Johnson, 752 DeBarr St., Norman, Okla.; No. 463, Guy Yandall Williams, 468 Elm Ave., Norman, Okla.; No. 464, Mor-

timer Mann Smith, 1800 N. 15th St., Philadelphia, Pa.; No. 465, Horace B. Morse, Llanerch, Pa.; No. 466, Peter L. Peschel, 606 Freeman St., Valparaiso, Ind.; No. 467, Ephraim D. Irvine, 536 South Clark St., Chicago, Ill.; No. 468, Joseph G. Cadora, Mass. College of Pharmacy, Boston, Mass.; No. 469, Benjamin Robert Kupperstein, 32 Vesta Road, Dorchester, Mass.; No. 470, Tulley J. Pomerantz, 9533 Cameron St., Detroit, Mich.; No. 471, Edgar Covel Austin, Cincinnati General Hospital, Cincinnati, Ohio; No. 472, Walter L. Loubat, 510–516 Bienville St., New Orleans, La.; No. 473, Henry Cook Richards, Tulane Univ., 800 Broadway, New Orleans, La.; No. 474, Elliott Jacobs, 1237 So. Rampart St., New Orleans, La.; No. 475, Wilfred W. Treece, 1900 Louisiana Ave., New Orleans, La.; No. 476, Daniel Geo. Addison, 1707 Second St., New Orleans, La.; No. 477, Guy Hanson, Pass Christian, Miss.; No. 478, Orion Page, Page's Drug Store, Vidalia, Ga.; No. 479, Harry Lewis Guffin, 150 Grove Ave., Highland Park, Mich.

A. G. DuMez, *Secretary.*

PROCEEDINGS OF THE LOCAL BRANCHES

"All papers presented to the Association and its branches shall become the property of the Association, with the understanding that they are not to be published in any other publications than those of the Association, except by consent of the Committee on Publication."— By-Laws, Chapter X, Art. III.

Reports of the meetings of the Local Branches should be mailed to the Editor on the day following the meeting, if possible. Minutes should be typewritten, with wide spaces between the lines. Care should be taken to give proper names correctly, and manuscript should be signed by the reporter. To maintain its activity and representation each Branch should see that at least three of its meetings during the year are reported in the Journal.

BALTIMORE.

A well-attended meeting of the Baltimore Branch of the American Pharmaceutical Association was held at the Emerson Hotel on Wednesday evening, April 20, 1921, President J. C. Krantz, Jr., presiding.

Dr. Charles C. Plitt gave a very interesting and instructive talk on the subject "Ferns Indigenous to Baltimore," which address was illustrated with lantern slides.

The remainder of the evening was devoted to expressions of regret at the death of Dr. Henry P. Hynson, who was one of the leaders in the organization of the Baltimore Branch, and who was always interested and ready to assist in planning and carrying on any work helpful to the Branch.

The following resolutions were unanimously adopted:

"WHEREAS, Our honored and beloved friend, Dr. Henry P. Hynson, has been removed from our midst by death; therefore be it

Resolved, That in the death of Dr. Henry P. Hynson, the Baltimore Branch of the American Pharmaceutical Association has lost one of its most useful and influential members—one who was ever ready to respond to the call of duty and one who gave to us freely the benefit of his valuable experience and wisdom.

Resolved, That we recognize his devotion and loyalty to his chosen profession, his friends and his community. Especially do we acknowledge the debt of gratitude we owe to him for the intelligence with which he planned and the sagacity with which he executed his many efforts to place American Pharmacy upon a higher and firmer plane.

Resolved, That we respectfully extend to his family our earnest and tender sympathy, and that these resolutions be spread upon the minutes of the Branch and that copies be sent to the family of the deceased and to the JOURNAL OF THE AMERICAN PHARMACEUTICAL ASSOCIATION."

B. OLIVE COLE,
Secretary-Treasurer.

CHICAGO.

The 118th monthly meeting of the Chicago Branch of the American Pharmaceutical Association was held Friday evening, April 29, at the University of Illinois School of Pharmacy; President C. M. Snow presided.

Upon motion a committee was appointed to report at the next meeting regarding the matter of exhibit by the Chicago Branch at the annual meeting of the Illinois Pharmaceu-

tical Association to be held in Chicago June 21. Messrs. Day, Gray and Gathercoal were appointed members of this committee. A motion was unanimously adopted expressing sympathy and condolence to the family of Henry P. Hynson in their bereavement, due to the recent death of Professor Hynson, and a copy of this resolution was directed to be sent to the family.

Harold N. Bruun presented the objects and aims of the Committee on Commercial Interests of the Illinois Pharmaceutical Association in connection with its coming Chicago meeting, and invited all members of the Chicago Branch to be present at the meeting and to take active part in its proceedings. He stated that at least one whole afternoon would be devoted to the addresses on commercial subjects and that the exhibits would consist largely of such articles as are of especial usefulness in the drug store.

Prof. O. V. R. Smith presented a very interesting lecture on the preparation of pharmaceuticals and biologicals, illustrated by moving pictures prepared at the plant of Parke, Davis & Co. His lecture was much appreciated and a vote of thanks extended.

E. N. GATHERCOAL,
Secretary.

DENVER.

The March meeting of the Denver Branch, A. Ph. A., was held at Baur's on the evening of March 15th, preceded by a dinner as usual. Thirty members were present and five new members were elected.

A vote of confidence in their integrity and honesty of purpose was extended to two members who had recently been prosecuted for the sale of substandard preparations, the evidence tending to show that while the samples, on which the prosecution was based, were substandard, that fact was not known to the men involved.

The status of the pharmacy bill in the Legislature was presented by Messrs. SeCheverell and Mortenson, who believed it had a good show for enactment.

Mr. Wilbur F. Cannon, the present incumbent, was endorsed for the position of Pure Food and Drug Commissioner.

Mr. SeCheverell stated that the law requiring that prescriptions for venereal diseases be reported to the City Health Officer, applies only in the event that the prescriptions bear the doctor's case number. It was agreed that copies of such prescriptions should not be given, unless they be used by others than those for whom the doctor had prescribed.

A recent City Ordinance requires the use of a Skull and Cross-Bones label on all containers of "medicated" alcohol, which, if taken literally, would include such articles as Spirit of Camphor, etc. The intention was to require the poison label only on "denatured alcohol" containing wood alcohol, but, unfortunately, the wording makes it to include non-poisonous alcoholic compounds as well. The legislative committee promised to endeavor to secure the repeal of this ordinance, or such amendment as may be necessary.

The candidacy of Wm. B. Warrington, a South Denver druggist, for a place in the City Council was announced and support was asked from all who reside in his district.

A resolution was adopted, protesting against the increasing list of "alcoholic preparations fit for beverage use," and the difficulty attendant upon their purchase from wholesalers. The belief was expressed that if the sale of all preparations containing more than one-half of one percent of alcohol and possible to use for beverage, was restricted to pharmacists, there would be no need for further restrictions.

A general sales tax, to take the place of the numerous forms of taxation now prevailing, was discussed, and given unanimous approval, and the secretary instructed to communicate our views and desires to our representatives in Congress.

The proposition of preparing and caring for the N. A. R. D. meeting to be held in Denver the week of September 19, was discussed at length, resulting in an agreement that the officers of the Denver Pharmaceutical Association and of the Branch be constituted a general committee to have full charge of the whole matter, with power to select or appoint such subcommittees as may be deemed necessary. Acting upon this authority a finance committee, with A. W. Clark as chairman, was appointed. Mr. Clark immediately took up the work, and in a few minutes had secured subscriptions amounting to two thousand dollars.

It was suggested that the State Pharma-

ceutical Associations of adjoining states be invited to hold their 1921 meetings in Denver, just before the N. A. R. D. meeting, this plan having already been decided upon by the Colorado Association.

NEBRASKA.

The March meeting of the Nebraska Branch of the American Pharmaceutical Association was held in one of the lecture rooms of the College of Pharmacy. The evening was devoted to a preliminary report by Albert Schneider on the cause of cancer. The investigations to date would indicate that cancer and other tumor formations are caused by a plasmodium which completes its sexual or definitive cycle in species of amoeba, the asexual cycle developing in man and other animals as cancer and other tumor formations.

The meeting was well attended and the paper was fully discussed.

RUFUS A. LYMAN,
Vice-President.

NEW ENGLAND BRANCH AMERICAN PHARMACEUTICAL ASSOCIATION.

A regular meeting of New England Branch A. Ph. A., was held on Tuesday evening, March 26th, at The Massachusetts College of Pharmacy; President Florin J. Amrhein presided.

The regular order of business was disposed of, after which various topics of interest were discussed, one being "The Substitution for Alcohol in Pharmaceutical Preparations."

Florin J. Amrhein presented samples of essences and extracts in which he had replaced the alcohol content with glycerin. A like sample of aromatic elixir was exhibited.

Discussions followed, and the majority seemed in favor of reducing the alcoholic content in preparations. On the other hand, arguments were presented showing the great value of alcohol as a most useful and desirable solvent and, rather than reducing the use of it, means should be sought by which it might be obtained tax-free for legitimate pharmaceutical purposes.

A brief outline of the uses of the various denatured alcohols was then presented.

Prof. Reid Hunt of Harvard Medical School told of the toxicity of the various alcohols and solvents which might partially replace the use of alcohol. He also spoke on the progress of the work of the new Pharmacopoeia.

A buffet lunch served in the Alumni room followed the meeting.

LESLIE B. BARRETT,
Secretary.

NEW YORK.

The April 1921 meeting of the New York Local Branch of the American Pharmaceutical Association was called to order in the Lecture Hall of the New York College of Pharmacy Building, Monday, April 11, 1921.

Forty-eight members and friends were present.

The minutes of the preceding meeting were read and approved.

Treasurer's Report.—The Treasurer's report was received and ordered filed.

Audit Committee.—Dr. Diner reported all bills paid.

Education and Legislation.—Mr. Eddy brought in a report which, after some discussion, was accepted with the thanks of the Association.

Member of the Council.—Dr. Hostmann reported upon several motions which have recently been passed by the Council.

Communications.—A letter from the Profession Guild was read and ordered filed.

SCIENTIFIC SESSION.

Dr. Diekman, Chairman of the Committee on Progress of Pharmacy, brought in a report consisting of many abstracts of recent articles. This was ordered received with the thanks of the Association.

Dr. Mayer read a paper on "Balancing Oxidation and Reduction Reactions." An interesting discussion followed. Dr. Rehfuss then read his paper on "The Teaching of Commercial Pharmacy and Jurisprudence in the Colleges of Pharmacy and Examinations Therein by Boards of Pharmacy," which was discussed by Dr. Jacob Diner and Dr. R. P. Fischelis.

A rising vote of thanks was extended to the speakers.

HUGO H. SCHAEFER, *Secretary.*

NORTHERN OHIO.

The Northern Ohio Branch of the American Pharmaceutical Association held its first meeting of the 1921–1922 season, January 21, at Western Reserve University, President O. E. Muhlhan presiding.

After the transaction of regular business, the following officers were reëlected for the year:

President, O. E. Muhlhan.

Vice-President, Prof. Edw. Spease.

Secretary-Treasurer, W. F. Hagemeister.

Dr. E. E. Stanford gave a very interesting lecture on various drugs, illustrated by lantern slides, prepared by him. A vote of thanks was extended the lecturer.

WALTER F. HAGEMEISTER,
Secretary.

PHILADELPHIA.

The April meeting of the Philadelphia Branch of the American Pharmaceutical Association, held April 12th at the Philadelphia College of Pharmacy and Science, was distinctly unique in the wide variety of papers presented and also in the exceptionally large attendance. President J. W. England presided and after the usual routine business had been transacted, he presented as the first speaker of the evening Dr. Thos. S. Jackson, Assistant Commissioner of Health of Pennsylvania, who gave an interesting talk on the Dominican Republic. Dr. Jackson, previous to his return, had charge of the Medical and Sanitary activities of the U. S. Naval Administration of the Dominican Republic. Dr. Jackson gave us a general idea of the very comprehensive scheme of roads, hospitals and public buildings planned by the Naval Administration. It seems that excellent plans had been laid for the control of leprosy, smallpox and the fevers; these were in partial application at the time of his return. Dr. Jackson had many other interesting statistics and opinions on the political and social aspects of the country which he presented.

"The Volatility of Ethyl Nitrite from Spirit Nitrous Ether" was the subject of a paper delivered by Mr. John Roberts. Some most amazing facts had been gathered by him and from his statements spirit of nitrous ether would be a boon to the manufacturer of home-made "hooch," which again presents some very perplexing problems to the now over-burdened pharmacist.

A botanical trip through the various valleys and by-roads surrounding Philadelphia was then conducted by Prof. M. S. Dunn. Many were present who renewed their acquaintance with forgotten spring flowers; all thoroughly enjoyed the interesting ramble. Herbarium sheets were passed among the members, illustrating much of the spring foliage discussed.

The contributors were all thanked for the excellent instructive manner in which they had entertained the members.

JOS. W. E. HARRISSON,
Secretary.

PITTSBURGH.

At a meeting of the Pittsburgh Branch of the American Pharmaceutical Association, March 29th, the following officers were elected: *President*, Henry L. Lohmeyer; *Vice-President*, Edward C. Nied; *Secretary*, B. E. Pritchard; *Treasurer*, P. Henry Utech.

The feature of the evening was an illustrated lecture on "The Collection and Standardization of Vegetable Drugs," by Dr. W. M. Bryan, who illustrated his talk with numerous slides showing views of foreign cities which are familiarly known as world drug markets, and how the native brokers buy and sell their commodities. Tables were presented showing wide variations existing in plants of the same kind, but gathered in different localities and at different seasons. These variations show an alkaloidal content of, at times, but one-fifth of that demanded by the U. S. P., while others contained as much as four times the official standard, thus proving that proper standardization is absolutely essential to the marketing of pharmaceutical preparations. The speaker then exhibited numerous pictures, showing how various animals are employed during standardizing biological products.

President L. K. Darbaker followed with a supplemental demonstration in the use of the frog for standardizing official preparations of digitalis.

A vote of thankful appreciation was given Dr. Bryan for his very instructive lecture.

LOUIS SAALBACH,
Secretary, pro tem.

(Reports of other Branches will be concluded in next issue. Delay due to Printers' strike.)

EDITORIAL NOTES

Editor: E. G. EBERLE, Bourse Building, Philadelphia, Pa.

Committee on Publication: A. G. DUMEZ, *Chairman;* J. H. BEAL, CHARLES H. LAWALL, CASWELL A. MAYO, H. B. MASON, and the Editor-in-Chief of the JOURNAL, General Secretary, Treasurer and Reporter on the Progress of Pharmacy, *ex-officio.*

Collaborators: C. HERBERT PACKARD, President, A. Ph. A.; WILBER J. TEETERS, President, A. C. P. F., H. C. CHRISTENSEN, Secretary, N. A. B. P., E. FULLERTON COOK, Chairman, U. S. P. Revision Committee; CHARLES H. LAWALL, Chairman, Council A. Ph. A. The Chairmen of the Sections A. Ph. A.: A. G. DUMEZ, IVOR GRIFFITH, EDWARD SPEASE, ADAM WIRTH, CURT P. WIMMER and E. F. KELLY.

A FRENCH DRUG COLLEGE.

The *Chemist & Druggist* of April 2 states that the success of the German "drug colleges" (that of Stuttgart is said to have granted one thousand or more diplomas) has suggested to the Paris Wholesale Druggists' Association a scheme for the technical education of their employees. Prof. Perrot, of the Paris Faculty of Pharmacy, has offered to organize and direct the courses of study, aided by M. Goris, assistant-professor at the Faculty; M. Mascré, hospital pharmacist; MM. Maheu and Weitz, preparators; M. Blaque and M. Liot. He thinks 5,000 fr. will cover the cost. The general idea is to give employees of drug firms the chance of examining and studying at leisure the products they handle; and as greater efficiency in business usually implies the possibility of a higher salary, it is hoped that the employees will understand the desirability of devoting their time to this subject.

THE JOHN SCOTT MEDAL.

The John Scott Medal may have more than ordinary interest for pharmacists. Little is known relative to the career of the donor, a citizen of Edinburgh, Scotland, and a "chemist," who died in 1816. The original bequest amounted to $4000, and was made to the City of Philadelphia, the income to be awarded to men and women who make useful inventions. The fund has grown to over $100,000, and is now given for inventions and advancements in any science, or the development that may add to the comfort, welfare and happiness of mankind.

The recent awards were made, among others, to Dr. Hideyo Noguchi, of New York City, "for eminent work in the discovery of disease-producing organisms and the means of combating their action;" and Edward C. Kendall, head of the section of chemistry in the Mayo Clinic at Rochester, Minn., "for bio-chemical work leading to the preparation of the compound 'thyroxin,' the determination of its chemical structure and giving results which contribute to the comfort and welfare of mankind." The name of Madame Marie Sklodowska Curie has been submitted to the Philadelphia Board of City Trusts for the honor, and the presentation will be made at some time during her coming visit, this month, to the United States. Madame Curie's qualifications are thus set forth in the formal recommendation of the Advisory Board:

"By the discovery of radium and by the determination of its radioactive properties, Madame Curie has given to the world an agent of great importance.

"The study of radium and of its disintegration products has led to a fuller understanding of atomic structure than could have been arrived at by any other means, and clearer understanding of the relation of matter to electricity.

"Through this study of atomic structure a vast new storehouse has been revealed."

BUSINESS AT SCHOOL.

In a paper presented by Caswell A. Mayo before Minnesota Pharmaceutical Association, he refers to *Bulletin* No. 22, issued by the Bureau of Business Research of the Graduate School of Business Administration of Harvard University. In this bulletin a study of statistics gathered in 187 retail drug stores, during 1919, is presented, and is full of valuable suggestions. The universities have realized that a knowledge of fundamental principles of business is essential to an education. The University of Pennsylvania announces that every important phase of the applied science of modern business is to be covered in the graduate course in business administration next year, based on the acceptance, that the more a

man knows about his business the better business man he is.

PERSONAL AND NEWS ITEMS.

Dr. Carl Johns, identified with the du Pont interests at Wilmington, Del., has been mentioned for the position of chief of the Bureau of Chemistry, to succeed Dr. Carl L. Alsberg, resigned. Dr. William Frear, of State College of Pennsylvania, and Dr. J. K. Haywood, chairman of the insecticide and fungicide board of the U. S. Department of Agriculture, have also been spoken of for the appointment.

Hugh Craig has joined the editorial staff of the *Oil, Paint and Drug Reporter*. Until his resignation, Mr Craig was advertising manager and publicity director of the Nyal Company, prior to that time editor of the *N. A. R. D. Journal*, and previously of the editorial staff of the *Druggists' Circular*.

The National College of Pharmacy, Washington, D. C., through Dean **H. E. Kalusowski,** has donated to the Museum for exhibition in the Division of Medicine, a suppository machine or mould made by James Dominic O'Donnell of Washington, D. C. It is believed to be the first mould ever used for making suppositories by compression, and has been installed in the case which contains old and modern specimens of pharmaceutical, equipment beside modern suppository machines and moulds.

Senator **Reed Smoot** was in the drug business during his earlier business career, and this has given him knowledge of the many laws and regulations druggists contend with.

A testimonial dinner was tendered **J. H. Rehfuss,** May 3. Mr. Rehfuss intends to make his home in Stockton, Cal., and has resigned his connections with the New York State Board of Pharmacy and the Brooklyn College of Pharmacy.

Dr. A. R. Bliss, who was seriously injured in an explosion at Emory College, Atlanta, is recovering, but we are advised that he will have a very long convalescence.

Representative **W. C. Wendt,** of the Ohio Legislature, is a Columbus druggist.

W. H. Duckworth, of Clovis, formerly secretary-treasurer of the New Mexico State Board of Pharmacy, was elected Lieutenant-Governor of New Mexico at the last election, and is now in office.

John F. Hancock, the veteran of ex-presidents of the American Pharmaceutical Association, has been on the sick list for a month or more. We are glad to report he is improving in health and gaining strength.

Dr. Carl L. Alsberg, chief of the Bureau of Chemistry, U. S. Department of Agriculture, has accepted the position of director of the Food Research Institute, recently established at Stanford University, California.

Admiral William C. Braisted, former Surgeon General, and President of the American Medical Association, has signified his acceptance of the presidency of the Philadelphia College of Pharmacy.

Walter L. Lyle, who is now serving his second term as member of the Virginia State Board of Pharmacy, has succeeded **J. E. Jackson,** as president of the Board.

OBITUARY.

HENRY PARR HYNSON.

A sketch of the late Prof. H. P. Hynson appears on the title page of this issue of the JOURNAL. He was stricken with arterial paralysis April 16, at his home in the Latrobe Apartments, and died on the following Tuesday at the University Hospital; the funeral services were conducted at Memorial Protestant Episcopal Church, April 23. Notwithstanding the unfavorable weather there was a large attendance, evidencing the esteem in which the deceased was held by his co-workers and fellow-citizens; the drug trade, universities, and the professions, were well represented, and the body was laid to rest in Druid Ridge Cemetery.

Mrs. Hynson, who was Miss Bettie Belle Limmo, of Marshall, Texas, to whom he was married in 1884, died several years ago. Henry P. Hynson, Jr., made the great sacrifice while in the service of the United States Navy, February 25, 1919; the widow of the latter and a grandson reside in Baltimore. Surviving the deceased are his daughter, Mrs. John Bayless, of Seattle, Washington; his son, William Rodney Hynson, of Los Angeles, Cal., and his sister, Mrs Benjamin Duval Camby, of Montgomery County, Maryland.

Louis Schulze, of Baltimore, pays tribute to the deceased, as one who can claim an unbroken friendship of thirty years with him.

He writes: "As many other younger men in pharmacy, the memory of material assistance given by precept, as well as practice, will endure throughout life. While Professor Hynson did not neglect the commercial side of his chosen vocation he ever held highest the professional, and always endeavored to impress upon his associates that it is highly essential for a pharmacist to receive proper remuneration for his services, and give due consideration in his transactions with his fellow-men to their moral and physical betterment. He was aggressive in spirit, quick to act, firm in the right as it appeared to him, unyielding in principle, and ever ready to acknowledge an error when convinced thereof by clear and conclusive reasoning. Those who knew him, as many knew him, will always say: 'He was a man, take him for all in all.' "

GEORGE CARLTON FRYE.

George C. Frye, member of the American Pharmaceutical Association since 1879, died at his home in Portland, Me., April 13, 1921. He was born in Vassalboro, Me., 78 years ago, and here he received his earlier education. He came to Portland in 1861, and entered the employ of E. L. Stanwood, and for a time was engaged with Thomas G. Loring. In 1867 he opened up a drug store on his own account, which developed into a wholesale and manufacturing business. Mr. Frye was successful in business life and contributed largely to the success of others. He was unostentatious, and few knew of his contributions to charity. He was deeply interested in the Mary Brown Home; to the Women's Literary Union he presented a home, and he gave substantial encouragement to all those promotions in which his wife's interest was enlisted. Jointly they found pleasure in doing good.

In his bequests the Women's Literary Union and the Coburn Classical Institute were well remembered. Mr. Frye attended the latter institute, and the gift is to be used for the erection of a dormitory. He also created a scholarship in Colby College which provides for annually defraying the expenses of a student in this institution; other donations are for hospitals, friends, employees, etc., and provisions have been made for further bequests. He was a member of the Masonic and other fraternal organizations, and of the Unitarian Church. He is survived by Mrs. Frye, who was Miss Eunice Nicholas of Vassalboro, and to whom he was married in 1880.

SOCIETIES AND COLLEGES.

LOCAL COMMITTEES AND CHAIRMEN NEW ORLEANS MEETING A. PH. A.

Local Secretary George W. McDuff advises the ASSOCIATION of the following appointments:—

F. C. Godbold, Chairman Emeritus
Christian Schertz, Chairman
George W. McDuff, Secretary
Joseph H. Berner, Treasurer

Finance Committee—Eugene H. Daste, Chairman; H. Stolzenthaler, Joseph T. Baltar, August Worner, J. N. W. Otto.

CHAIRMEN OF COMMITTEES.

Hotels, J. A. Legendre
Transportation, Adam Wirth
Badges, A. Di Trapani
Program, R. F. Grace
Exhibits, August C. Flach
Entertainments, Fred W. Ames
Registration, E. H. Walsdorf
Reception, M. B. Casteix
Music, Frank Nuccio
Press, George S. Humphreys.

Chairman McDuff and Chairman A. Ph. A. Membership Committee report much interest among local members and are preparing for a big meeting.

ATTENDANCE AT BRANCH MEETINGS.

The *Bulletin of Pharmacy* concludes an editorial on the subject of "Attendance at Branch Meetings" with the comment that, as a rule, the meetings are not well attended and "this condition holds despite the fact that at a majority of branch meetings papers are presented and discussions started that are of real practical value to every pharmacist. It does not matter whether he is interested in the commercial, professional or manufacturing phases of the subject; he is bound to hear much that can be utilized to his advantage.

"Pharmacists in cities where local branches of pharmaceutical associations are located are overlooking a good bet if they don't take advantage of the periodic meetings. And right now, even though the new year is already several months old, is a good time to turn over a new leaf by resolving not to miss a single meeting that it is possible to attend.

"By following such a plan both the individual and association will profit."

AMERICAN PHARMACEUTICAL ASSOCIATION

Organized: Philadelphia, 1852. Incorporated: Washington, D. C., 1888.

OFFICIAL ROSTER FOR 1920-1921.

GENERAL OFFICERS.

President—CHARLES HERBERT PACKARD.....46 Maverick Square, East Boston, Mass.
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Reporter on the Progress of Pharmacy—H. V. ARNY.....115 West 68th St., New York, N. Y.
Editor of Journal—E. G. EBERLE.....253 Bourse Building, Philadelphia, Pa.
Local Secretary—GEORGE W. McDUFF.....2712 Magazine St., New Orleans, La.

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Secretary—A. G. DUMEZ.....Hygienic Laboratory, Washington, D. C.
For list of Council Members see p. 722. For list of Council Committees see p. 719, July 1920.

OFFICERS OF THE SECTIONS.

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Second Vice-Chairman—FRANTZ F. BERG.....23 Vine St., Brooklyn, N. Y.
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Associates—PHILIP ASHER*.....New Orleans, La.
Associates—C. F. WALKER.....Medical College of Va., Richmond, Va.
* Deceased July 5, 1920.

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Secretary—H. M. FASER.....University, Miss.
Associates—D. F. JONES.....Watertown, S. D.
Associates—E. R. JONES.....350 Manistique Ave., Detroit, Mich.

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Secretary—C. W. HOLZHAUER.....53 Spruce St., Newark, N. J.
Associates—FRANK SCHACHLEITER.....P. O. Box 97, Little Rock, Ark.
Associates—SINCLAIR JACOBS.....Atlanta, Ga.
Associates—ADAM WIRTH, elected Chairman vice C. O. Lee.

SECTION ON HISTORICAL PHARMACY.

Chairman—CURT P. WIMMER.....115 W. 68th St., New York, N. Y.
Secretary—A. W. LINTON.....U. of Washington, Seattle, Wash.
Historian—E. G. EBERLE.....253 Bourse Building, Philadelphia, Pa.

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President—MRS. LEWIS C. HOPP.....1104 Euclid Ave., Cleveland, O.
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Treasurer—MRS. C. E. BENT.....Dell Rapids, S. D.
Chairman Executive Committee—MRS. LYMAN F. KEBLER.....Washington, D. C.
* Deceased June 19, 1920.

GENERAL COMMITTEES.

(Appointed by the President.)

1. INTERNATIONAL PHARMACEUTICAL NOMENCLATURE.

Otto Raubenheimer, *Chairman*...Brooklyn, N. Y.
Edward Kremers.....Madison, Wisconsin
G. M. Beringer.....Camden, N. J.
H. M. Whelpley.....St. Louis, Mo.
J. W. Sturmer.....Philadelphia, Pa.

2. HEALTH INSURANCE.

Harry B. Mason, *Chairman*.....Detroit, Mich.
Hugh Craig.....Detroit, Mich.
C. A. Mayo.....Cincinnati, Ohio
W. J. Teeters.....Iowa City, Ia.
W. C. Anderson.....Brooklyn, N. Y.

3. NATIONAL LEGISLATION.

S. L. Hilton, *Chairman*.....Washington, D. C.
John C. Wallace.....New Castle, Pa.
Jacob Rehfuss.....Brooklyn, N. Y.
A. R. L. Dohme.....Baltimore, Md.

4. PATENTS AND TRADEMARKS.

F. E. Stewart, *Chairman*.....Philadelphia, Pa.
W. A. Puckner.....Chicago, Ill.
S. C. Henry.....Chicago, Ill.
F. W. Nitardy.....Brooklyn, N. Y.
C. L. Alsberg.....Washington, D. C.

5. PHARMACEUTICAL SYLLABUS.

Harry B. Mason, P. O. Box 484, Detroit, Mich.....Term expires 1921
George M. Beringer, 501 Federal St., Camden, N. J.....Term expires 1922
H. H. Rusby, 776 DeGraw Ave., New York, N. Y.....Term expires 1923
Willis G. Gregory, 344 Richmond Ave., Buffalo, N. Y.....Term expires 1924
W. H. Rudder, 3 Lyons Block, Salem, Ind.....Term expires 1925
E. L. Newcomb, 719 6th Ave., S. E., Minneapolis, Minn.....Term expires 1926
E. G Eberle, 253 Bourse Building, Philadelphia, Pa.....Term expires 1927

6. PHYSIOLOGICAL TESTING.

Paul S. Pittenger, *Chairman*....Philadelphia, Pa.
W. A. Pearson.....Philadelphia, Pa.
H. C. Hamilton.....Detroit, Mich.
Henry C. Colson.....Baltimore, Md.

7. REVISION OF CONSTITUTION AND BY-LAWS.

J. H. Beal, *Chairman*.....Urbana, Ill.
F. W. Meissner.....LaPorte, Ind.
H. M. Whelpley.....St. Louis, Mo.
G. M. Beringer.....Camden, N. J.
A. G. DuMez.....Washington, D. C.

8. STATUS OF PHARMACISTS IN GOVERNMENT SERVICE.

E. Fullerton Cook, *Chairman*...Philadelphia, Pa.
G. M. Beringer.....Camden, N. J.
C. A. Mayo.....Cincinnati, Ohio
Robt. P. Fischelis.....New York, N. Y.
E. G. Eberle.....Philadelphia, Pa.

9. UNITED STATES PHARMACOPOEIA.

E. H. LaPierre, Cambridge, Mass.....Term expires 1921
H. A. B. Dunning, Baltimore, Md.....Term expires 1922
Hermann Engelhardt, Baltimore, Md.....Term expires 1923
A. B. Lyons, Detroit, Mich.....Term expires 1924
William Mittelbach, Boonville, Mo.....Term expires 1925
Reid Hunt, Boston, Mass.....Term expires 1926
L. D. Havenhill, Lawrence, Mass.....Term expires 1927
L. F. Kebler, *Chairman*, Washington, D. C.....Term expires 1928
E. N. Gathercoal, Chicago, Ill.....Term expires 1929
E. Fullerton Cook, Philadelphia, Pa.....Term expires 1930

10. WEIGHTS AND MEASURES.

Jeannot Hostmann, *Chairman*....New York, N. Y.
H. V. Arny.....New York, N. Y.
H. M. Faser.....University, Miss.
C. M. Snow.....Chicago, Ill.
T. J. Bradley.....Boston, Mass.

11. WILLIAM PROCTER, JR., MEMORIAL FUND.

J. F. Hancock, *Chairman*.....Baltimore, Md.
A. R. L. Dohme.....Baltimore, Md.
B. T. Fairchild.....New York, N. Y.
Caswell A. Mayo.....Cincinnati, Ohio
E. G. Eberle.....Philadelphia, Pa.
J. L. Lengfeld.....San Francisco, Cal.
C. M. Ford.....Los Angeles, Cal.
Clement B. Lowe.....Vineland, N. J.
William B. Day.....Chicago, Ill.
L. E. Sayre.....Lawrence, Kans.
Parker Cook.....Baltimore, Md.
J. K. Lilly.....Indianapolis, Ind.
H. S. Wellcome.....London, Eng.
Chas. G. Merrell.....Cincinnati, Ohio
José P. Alacan.....Havana, Cuba
E. L. Patch.....Stoneham, Mass.
Lewis C. Hopp.....Cleveland, Ohio
James E. Hancock.....Baltimore, Md.
W. S. Richardson.....Washington, D. C.

12. TIME AND PLACE OF NEXT MEETING.

Theodore J. Bradley, *Chairman*....Boston, Mass.
S. L. Hilton.....Washington, D. C.
W. F. Rudd.....Richmond, Va.
F. W. Nitardy.....Brooklyn, N. Y.
E. Spease.....Cleveland, Ohio

13. BOARD OF CANVASSERS FOR 1921.

John G. Godding, *Chairman*.....Boston, Mass.
Fred W. Archer.....Milton, Mass.
I. P. Gammon.....Brookline, Mass.
E. H. LaPierre.....Cambridge, Mass.
Chas. A. Stover.....Cambridge, Mass.
C. B. Wheeler.....Hudson, Mass.

14. CLOSER AFFILIATION OF PHARMACISTS AND PHYSICIANS.

Jacob Diner, *Chairman*.....New York, N. Y.
Wm. Gray.....Chicago, Ill.
Reid Hunt.....Boston, Mass.
I. A. Becker.....Chicago, Ill.
H. A. B. Dunning.....Baltimore, Md.

15. LOCAL BRANCHES.

Ivor Griffith, *Chairman*.....Philadelphia, Pa.
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STATE.	DATE.	PLACE.	PRESIDENT.	SECRETARY.	LOCAL SECRETARY.
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Arizona			J. H. Barnett, Mesa	T. E. Thorpe, Phoenix	
Arkansas	June 15–17	Little Rock	Wm. G. Ownbey, Springdale	Mary A. Fein, Little Rock	
California	May 17–19	Curry Camp	C. W. Hartsough, San Diego	E. A. Henderson, Los Angeles	Al Tienken, Lindsay
Colorado	September 19	Denver	L. A. Jeancon, Denver	Charles J. Clayton, Denver	
Connecticut	June 21–22	Groton	S. S. Nelson, Hartford	P. J. Garvin, Middletown	
Delaware	June 2	Wilmington	Geo. W. Rhodes, Newark	R. H. Newsome, Wilmington	
Florida	June 15–16	Miami	George R. Cherry	J. H. Haughton, Palatka	
Georgia	June	Atlanta	David G. Wise, Atlanta	T. A. Cheatham, Atlanta	
Idaho	October 13–14	Boise	Frank Murray, Twin Falls	T. M. Starrh, Boise	
Illinois	June 21–23	Chicago	W. J. Clancy, LaSalle	W. B. Day, Chicago	W. B. Day
Indiana	June 21–23	Culver	T. B. Crigler, Attica	W. A. Oren, Indianapolis	
Iowa			George Judisch, Ames	Al Falkenhainer, Algona	
Kansas	May 10–12	Winfield	N. G Edelblutt, Topeka	D. F. Deem, Stark	M. Backus
Kentucky	June 21–24	Crab Orchard	J. L. Wilson, Mayfield	J. W.Gayle, Frankfort	E. R. Coleman, Stanford
Louisiana	September 5–10	New Orleans	W. N. Wilson, Independence	George W. McDuff, New Orleans	
Maine	September 7–9	Belgrade Lakes	S. L. White, Houlton	M. L. Porter, Danforth	
Maryland			George E. Pearce, Frostburg	E. F. Kelly, Baltimore	J. H. Dow
Massachusetts	June 13–14	Swampscott	A. J. H. Paquette, West Lynn	J. F. Guerin, Worcester	
Michigan	June 14–16	Detroit	J. A. Skinner, Cedar Springs	Louis V. Middleton, Grand Rapids	R. T. Lakey
Minnesota	February 7–9, '22	St. Paul	E. A. Grouchau, Duluth	Gustav Bachman, Minneapolis	
Mississippi	June 14–15	Jackson	S. M. Covington, Summit	A. S. Coody, Jackson	M. E. Ward
Missouri	June 14–17	Excelsior Springs	C. H. McDonald, Rocky Comfort	H. M. Whelpley, St. Louis	H. C. Tindall
Montana			J. W. Seiden, Lewistown	J. A. Riedel, Boulder	
Nebraska	June 7–9	Columbus	G. Turner Haines, Omaha	J. G. McBride, University Place	W. A. Goodwin
Nevada	June	Reno	N. H. Van Alstine, Yerington	Lester J. Hilp, Reno	
New Hampshire			S. H. Whiting, Raymond	Eugene Sullivan, Concord	
New Jersey	June 14–17	Spring Lake	Harry W. Crooks, Newark	Jeannot Hostmann, Hoboken	Daniel H. Hills
New Mexico			B. Ruppe, Albuquerque	Mrs. M. L. Powell, Albuquerque	
New York	June 20–24	Stamford	R. S. Lehman, New York, N. Y.	E. S. Dawson, Syracuse	
North Carolina	June 21–23	Charlotte	E. E. Missildine, Tyron	J. G. Beard, Chapel Hill	R. K. Blair
North Dakota		Fargo	Homer Hill, Marion	W. F. Sudro, Agricultural College	Oscar Hallenberg
Ohio	July 11–14	Cedar Point	Frank Schwilk, Dayton	Theo. Wetterstroem, Columbus	L. A. Biehl, Sandusky
Oklahoma	April 1922	Oklahoma City	Clarence Pullen, Muskogee	H. S. Shackelford, Wynnewood	
Oregon	July	Seaside	E. A. Robinson, Portland	A. W. Allen, Portland	
Pennsylvania	June 8–10	Philadelphia	W. J. Sturgeon, Kittanning	Louis Saalbach, Pittsburgh	Ambrose Hunsberger
Rhode Island			Earl H. Mason, Providence	Owen E. Barrett, Providence	
South Carolina	June 21–23	Charlotte, N. C.	S. C. Hodges, Greenwood	F. M. Smith, Charleston	
South Dakota	August 17–19	Sioux Falls	Selmer Solem, Kadoka	E. C. Bent, Dell Rapids	M. Goebel
Tennessee	July 19–21	Chattanooga	B. B. Kerr, Murfreesboro	D. J. Kuhn, Nashville	T. O. Duff
Texas	June 16–18	San Antonio	W. C. Burns, San Antonio	W. H. Cousins, Dallas	W. H. Whisenant
Utah	May 26–27	Logan	C. E. Driver, Ogden	E. L. Smith, Salt Lake City	
Vermont			Harris Alexander, St. Albans	J. B. Lambert, Burlington	
Virginia	June 21	Natural Bridge	J. B. Clower, Woodstock	A. L. I. Winne, Richmond	
Washington			A. J. Tozer, Everett	A. W. Linton, Seattle	
West Virginia	May 25–26	Parkersburg	I. S. Davis, Huntington	P. H. Kelly, Montgomery	F. C. Kramer
Wisconsin	August 2–5	Eau Claire	B. F. Leidel, Milwaukee	E. G. Raeuber, Milwaukee	O. J. S. Boberg
Wyoming			A. E. Roedel, Cheyenne	Clyde Smith, Torrington	

* Secretaries will oblige by making corrections and giving list of new officers. Please address JOURNAL A. PH. A., 253 Bourse Bldg., Philadelphia, Pa.

AMERICAN DRUG MANUFACTURERS' ASSOCIATION.

The American Drug Manufacturers' Association reëlected William A. Sailer, of Baltimore, President. The other new officers are: Vice-presidents, James E. Bartlett, Detroit; Willard Ohliger, Detroit; and Charles G. Merrell, Cincinnati; Secretary, W. J. Woodruff, of Washington, D. C. (reëlected); and Treasurer, Franklin Black, New York.

James F. Pardee, Midland, Mich., and S. B. Penick, New York, were elected as members of the Executive Committee for the ensuing term. The other members of the committee are the officers and Burton T. Bush, of New York, and C. M. Woodruff, of Detroit.

Resolutions were adopted favoring the retention of the revenue tax on alcohol for nonbeverage uses; to replace surtaxes and other existing revenue measures by a sales tax. The Association expressed recognition of the necessity for the protection of the American chemical industry and petitioned Congress to act promptly in the matter. Several other phases of Federal regulating acts were considered during the meeting, and official utterances were pronounced in favor of the simplification of the regulations upon handling of alcohol and narcotics for strictly legitimate purposes. Compulsory public health insurance was condemned as demoralizing to the State and the efficiency of the individual and burdensome to the taxpayer.

President Sailer presented a comprehensive address covering the many legislative and organization interests of the Association, and its activities. He favored the stabilizing of the Association by departing from the precedent of confirming its personnel to a one-year term of office. Speaking on the question, he said:

"Under this arrangement the second year of a committee's existence would find it fully organized and possessed of a proper conception of its duties, and, perhaps, with a working program completed. The committee, in other words, would be ready for two or three solid years of work.

"We also have the consideration that in the past the committees have probably hesitated to frame any very comprehensive programs knowing as they did that their term of office would not allow them sufficient time for their completion, and feeling, perhaps, that the framing of programs for a longer period might seem presumptuous to their successors."

PHARMACEUTICAL RESEARCH.

The following resolution was adopted:

Resolved, That the American Drug Manufacturers' Association express its approval of and hearty sympathies with the research committee of the AMERICAN PHARMACEUTICAL ASSOCIATION, and also that we shall be very glad to coöperate by appointing a delegate to the next stated meeting of that committee.

SCIENTIFIC SECTION.

Dr. J. M. Francis presided at the meeting of the Scientific Section.

The work of 19 subcommittees was reviewed as follows:— Acetyl Salicylic Acid, by Dr Jules Bebie; Aconite, by Dr. A. R. L. Dohme; Cannabis, by Dr. A. Walter; Chloroform and Ether, by Dr. J. M. Francis; Control Assays, by J. M. Francis; Crude and Milled Drugs, by S. B. Penick; Digitalis, by Dr. P. S. Pittenger; Diluents, Excipients, Extracts, by Prof. R. W. Proctor; Drug Extracts, by Dr. J. P. Snyder; Essential Oils, by Dr. G. F. Richmond; Laboratory Management, by Dr. F. B. Kilmer; Malefern, by Dr. A. R. L. Dohme; Miscellaneous Alkaloid and Drug Standards, by Dr. A. R. L. Dohme; Miscellaneous Chemical Tests and Standards, by Dr. J. Rosin; Nitroglycerin, by Dr. J. M. Francis; Pepsin, etc., by Dr. Frederick Fenger; Pituitary Extract, by Dr. E. M. Houghton; Surgical Dressings and Plasters, by Dr. F. B. Kilmer; Weights and Measures, by Dr. J. P. Snyder.

Declaring that all humanity would be benefited by the establishment of a $10,000,000 national institute of drug research in this country, Edwin E. Slosson, editor of the "Science Service" of the National Research Council, in an address before the section, said that the making of drugs was developing along the lines of discovery and cultivation of new medicinal plants and in the invention of synthetic remedies. The following are some of his pertinent points, taken from the report of the *Oil, Paint and Drug Reporter*:—

"The time has come for man to make a declaration of independence of the vegetable kingdom.

"The future pharmacologist will rely upon his own resources and, having first found out the real cause of the disease, will then set out to devise and construct a compound that counteracts it specifically with as little incidental injury to the patient as possible.

"Pharmacists are the defenders of our lives against foes more dangerous than those of the late war. Even during that conflict the Allies suffered more fatalities from the germs than from the Germans. Success in chemical warfare, whether with munitions or medicinals, depends upon scientific research. We must invent new weapons of attack and means of defense, antiseptics and prophylactics.

In the drug business there is opportunity for development, first, in the discovery of new medicinal plants, second, in their cultivation for the increase of the active principle and. third, in the invention of synthetic remedies.'

THE PHARMACIST AND THE LAW.

SALES TAX BILLS.

The bill introduced by Senator Smoot seeks to repeal the tax on proprietary medicines and toilet articles imposed by Section 907 of the Revenue Act of 1918; Sections 628, 629 and 630, under which it is necessary to make monthly returns and tax imposed on ice cream, soda fountain beverages, mineral waters, etc. If enacted, the provisions become effective July 1, 1921.

The Smoot bill provides for a tax "upon all goods, wares or merchandise sold or leased on or after July 1, 1921, equivalent to 1 per centum of the price for which sold or leased, such tax to be paid by the vendor or lessor." This sales tax provision "shall not apply to sales and leases made during any year in which the total price for which the taxable sales and leases are made does not exceed $6,000."

Representative Bacharach's bill is much more comprehensive than the Smoot bill. The bill repeals the excess profits tax and in order that corporations may not have an advantage over individuals a new tax of 10 percent on undistributed earnings is imposed. The $2,000 corporation exemption is eliminated and the 10 percent normal tax of corporations is retained.

Miscellaneous taxes which are repealed by the bill are the transportation and insurance taxes, the tax on all fountain drinks and ice cream, a tax on admission and duties and certain of the special excise taxes such as the tax on candy, chewing gum, toilet soaps, carpets, rugs, wearing apparel, perfumery, cosmetic and medicinal preparations, etc.

RESOLUTIONS OF AMERICAN DRUG MANUFACTURERS' ASSOCIATION.

SALES TAX.

Resolved, That the American Drug Manufacturers' Association favors the levying on each and every business involving the sale of any commodities or merchandise produced, manufactured, or purchased by the vendor for sale, a tax not exceeding 1 percent of the gross sales of such business, and that such tax be collectable monthly from the vendor, who shall be compelled under penalty to keep a true record of such sales.

HARRISON ACT AMENDMENTS.

Resolved, That the American Drug Manufacturers' Association endorses the following recommendations of the Committee on Legislation, with respect to the Harrison Act:—

(1) That the definition of a wholesaler should be amended so as to read:—"Every person who sells or offers for sale any of said drugs for resale to others, shall be deemed a wholesale dealer."

(2) That the definition of a retail dealer should read:—"Every person who sells or offers for sale any said drugs for use or consumption, or who dispenses said drugs, shall be deemed a retail dealer."

(3) That the Harrison Act should be so amended as to carry out the intent of Congress, and obviate the injustice of a construction that taxes the inert and inexpensive diluent, solvent, vehicle, etc., as much per ounce as the narcotic content itself.

(4) That the Bureau of Internal Revenue should adopt a system of triplicate order forms, one copy to be retained by the party placing the order, in his own file, two copies to be sent by him to the jobber or manufacturer, the latter being required to forward one of these copies at the end of each month to the collector's office, retaining one for his own record of narcotic sales, and that no further record or reports be required.

SOCIAL INSURANCE.

Resolved, That the American Drug Manufacturers' Association hereby declares its belief in the following propositions:—

(1) That compulsory health insurance is contrary to the fundamental principles of American institutions in that it deprives the individual of the inherent right of disposing of his earnings as he sees fit and in that it tends to build up in our government a bureaucratic system that is repugnant to personal liberty.

(2) That compulsory health insurance tends to demoralize its supposed beneficiaries by destroying their self-reliance, encouraging them to live for to-day and let the government take care of to-morrow, and tempting them to shirk their just share of labor and secure their monetary support by malingering, thus lowering the thrift, morality and industriousness of our people generally.

(3) That compulsory health insurance tends to the utter demoralization of the medical profession in that it would make the practice of medicine a cheap contract proposition, attractive only to men of little ambition, incompetent of making a better living in other ways.

(4) That compulsory health insurance is demoralizing to the state in that it adds an overwhelming tax burden, due to the enormous expenses of administration and tends to build up an indifferent and parasitic army of government employees.

Resolved, That the Committee on Legislation be instructed to lend its most vigorous aid to the opponents of this movement.

STANDARD PHARMACEUTICALS HELD FREE FROM WAR REVENUE SALES TAX, REGULATIONS 51.

Under comprehensive amendments manufacturers of standard pharmaceuticals can place their names on their products, print usual indications, dosage, etc., without tax liability, provided these goods are held out to physicians and the drug trade solely, and not to the general public. The amendments follow:—

Article 12 (c), 14, 15, 16 (a) and (d), and 19 (b) of regulations 51 (revised, May 1920) are hereby amended to read as follows:—

Art. 12 (c). They are prepared, uttered, vended, or exposed for sale under any letters patent or a trade-mark appropriated to the particular article as distinguished from a general trade-mark applied by a manufacturer to his various products; or

Art. 14. Medicinal preparations:—Under private formula or exclusive right. Medicinal preparations as to which the manufacturer or producer claims to have any private formula, secret or occult art for making or preparing the same, are taxable. Medicinal preparations made according to a formula or process protected by means other than secrecy are held to be manufactured or produced under an "exclusive right or title." To render an article taxable it is not necessary that the exclusive right or title should actually be perfected or, so long as there is a claim thereto, that there be, in fact, any exclusive right or title.

Art. 15. Medicinal preparations:—Under letters patent or trade-mark.—Medicinal preparations sold under letters patent are taxable. A general trade-mark applied by a manufacturer or dealer to his various products does not of itself render such product taxable, but where a medicinal preparations is sold under what appears to be or what is intended to be a trade-mark appropriated to the particular article, the tax attaches. The coined name for a particular medicinal preparation, to distinguish it from the same or like preparations of other manufacture, is a trade-mark under section 907, and amounts to a holding out of that preparation as proprietary.

Art. 16. Medicinal preparations:—Held out.—(a) The taxability of a medicinal preparation is determined by the manner in which it is put upon the market. "Held out or recommended" includes representation by any means as by personal canvass, statements on labels, or in pamphlets or advertisements, or otherwise. The term "to the public" means the public at-large or general lay public. A holding out or recommendation intended only for physicians, pharmacists or druggists, or any of them, is not a holding out to the public.

(d) Many articles or substances which are not usually considered as belonging to materia medica may become taxable medicinal preparations by being held out or advertised as remedies for diseases affecting the human or the animal body; thus, boric acid when held out as a medicinal preparation or sold under a trade-mark as a medicinal preparation is

taxable, and licorice put up in sticks, lozenges or other forms suitable for medicinal purposes and sold under a trade-mark is subject to the tax. (See articles 12 and 15.)

Art. 19 (b) The autographic name of the company or manufacturer of a medicinal preparation, or the possessive use thereof, printed on the label, may or may not constitute a trade-mark and may or may not amount to a holding out of the preparation as proprietary, within the meaning of section 907 (a) (2), depending on the character of the preparation and the manner in which it is held out or recommended. (See article 14.)

BOOK NOTICES AND REVIEWS.

Laboratory Manual for the Detection of Poisons and Powerful Drugs. By Dr. William H. Autenrieth. Fifth American edition translated by William H. Warren, Ph.D., from the Fourth German Edition. Published by P. Blakiston's Son & Co., Philadelphia, 1921. Pp. xv + 342. Price $3.50.

The fifth English edition is a translation of the fourth German and contains but little matter not found in the fourth English edition which very closely followed the text of the fourth German edition.

An author's index has been added to the very complete subject index. Methyl alcohol has been added to the list of volatile poisons. Strange to say the author mentions none of its many synonyms and even the term "methanol" is missing.

The author has chosen the following from the long list of qualitative tests: Hinkel's, Denigès-Simonds, Copper Oxidation and Permanganate Oxidation Tests. Under the United States Pharmacopoeia test a very curious error appears: "If methyl alcohol is present, the liquid will be colorless after ten minutes' standing." This of course should read "If methy alcohol is absent, etc."

The book will undoubtedly continue to be very popular both as a textbook for the student and as a reference for the laboratory worker. JEANNOT HOSTMANN.

An Introduction to Chemical Pharmacology. By Hugh McGuigan, Ph.D., M.D., Professor of Pharmacology, University of Illinois. 8 vo. xii + 418 pages. Cloth $4.00. P. Blakiston's Son & Co., Philadelphia.

The author has made a comprehensive attempt to correlate the chemical structure of medicinal products with pharmacologic action. No book with this object can be expected to be final, yet a very laudable presentation of numerous chemical facts in a small scope has been accomplished.

"The writer is of the opinion that in the teaching of pharmacology, the chemical side should receive much more attention than it does at present. In this way the student will have an opportunity to review and add to his previous work in chemistry and enter the clinical years better equipped and with a fuller appreciation of the most promising avenue of advance."

To pharmacists, who are quite aware of the imperfections of the average physician in regard to chemical knowledge, the suggestion is made that this book would be a most helpful and appreciated gift. Even the pharmacist with his greater familiarity with things chemical could read it with profit to himself and greater safety to his customers. While obviously not intended to be an elaborate treatis on organic chemistry it contains much useful information in an accessible form.

Structural formulas are freely used throughout the text with identification tests and a brief statement of pharmacological action.

Paraffins, important drugs of the methane series, anesthetics, narcotics, soporifics, hypnotics, aldehydes, ketones, organic acids, iodoform, benzene, phenois, aromatic alcohols, aniline derivatives, carbohydrates, fats and oils, waxes, resins, glucosides, alkaloids, proteins, enzymes and colloids are all considered, which clearly shows that between the covers of this little book may be found a wealth of information which may be of practical value to the pharmacist, medical student and physician. W. A. PEARSON.

PUBLICATIONS RECEIVED.

Theses, which have been presented to the Pharmaceutical Faculty of the University of Paris for Doctor in Pharmacy degree.

No.1, Zinc in the Human Organism. By Sinicha Giaya, Pharmacist of the 1st Class; Licentiate in Science University of Belgrade.

The conclusions have been reached by him that zinc exists in all organs of the human body, and in the bodies of all animals, the proportion augmenting with the age of the ubject—oscillating between 10 and 50 milligrammes per kilogramme of viscera.

That the organs which contain the most are in the following order: The brain, lungs, stomach, intestines, liver, kidneys, heart, spleen, bones contain traces; urine, very little; human milk, about .0013 Gm. per liter.

No. 2, Urea, Ammonia and the Urinary Amino-acids—from the Analytical Point of View. By Jean Philibert, Pharmacist of the 1st Class, Ex-Interne Paris Hospitals, Prize Winner (1st and 2nd Prizes) Superior School of Pharmacy, Paris.

No. 3, On Some Derivatives of Anisic-Acetone. By Emilien Le Brazidec, Pharmacist of the 1st Class, Ex-Interne Paris Hospitals.

No. 4, On the Decomposition of the Quaternary Iodides of Hexamethylenetetramine by Boiling Water. By Edgard Deroux.

No. 5, Researches on the Oxidization of Mesityl Oxide by Potassium Permanganate and Hydrogen Dioxide. By Charles Launay, Pharmacist of the 1st Class, Ex-Interne Paris Hospitals, Pharmacist Aide-Major 1st Class attached to the Chemical Laboratory of the 11th Army.

No. 6, Preparation and Study of Isoamylcamphor and Some of Its Derivatives. By Felix Henri Martin, Pharmacist of the 1st Class, Licentiate in Science, Member of the Chemical Society of France, Commercial Assay-Chemist.

No. 7, Action of Iodine on Arsenous Acid and Its Phenylic Derivatives—A Comparative Study with Applications. By Paul Fleury, Chief Pharmacist of Asylums of the Seine, Preparer of Experiments to the Pharmaceutical Faculty.

No. 8, Microbic Fermentation in War Wounds. By Paul Jean-Marie Muraz, Pharmacist of the 1st Class, Prize Winner of the Pharmaceutical Faculty, Silver Medal in Micrography, Ex-Interne Paris Hospitals.

Conclusions reached in the foregoing study of Microbic Fermentation of War Wounds.

The infection of war wounds is nearly always progressive. The infection of the torn tissues by the projectiles (primitive infection) is soon increased in most cases by the introduction of new germs from dressings, manipulations, etc. (secondary infection).

1. The primitive infection is due to association of aërobes and anaërobes or to the aërobes alone. The wounds which contain the anaërobes are much more grave—comprising 40% to 80% of those sent from the front.

The immediate gravity of the infection comes from the development of anaërobes in the wound. Healthy, living tissue is not favorable ground for the development of anaërobes—they can only germinate in a tissue favorably prepared.

The preventive action of healthy tissue is due to living blood—a medium rich in oxygen, possessing powerful microbicidal properties. The more or less rapid extension of the anaërobic development depends upon the aërobic with which it is associated. The anaërobic microbes which develop in war wounds are the same as one finds in putrifying animal matter. They are associated with the same anaërobes as one finds in the same cases. They act in the same manner in tissue disorganized by projectiles as in putrifying meats.

The noxious action of these microbes is exercised in two ways:

a. Toxic action due to the absorption of putrid products.

b. Progressive invasion of the anaërobic putrid process.

The primitive infection can be also due to the action of aërobes alone—it then passes into a banal aërobic putrefaction, much less dangerous than the first and much less redoubtable.

Its noxious action upon the organisms is equally due:

a. To the absorption of the products of cytolyse.

b. (Cases happily more rare.) To the invasion, more or less rapid, of the organism by putrid aërobic germs (septicemia-pyemia).

2. The secondary infection is due to a species of aërobes; this is very frequent in war wounds—one can say that every wound left open will acquire new germs. Secondary infection comes along to complete the putrid action of the microbes in the primitive infection. It is less dangerous, the organism having had time to prepare new means of defense.

3. Each microbe in a war wound has an evolution peculiar to itself, and upon which antiseptics have but little action.

The suppression (amputation) of disorganized tissue—that is to say, of the putrescible region—is at the base of all treatments. In war wounds there is no specific infection, save in the presence of Streptococci and Tetanus bacilli—only a putrid progression.

W. H. GANO.